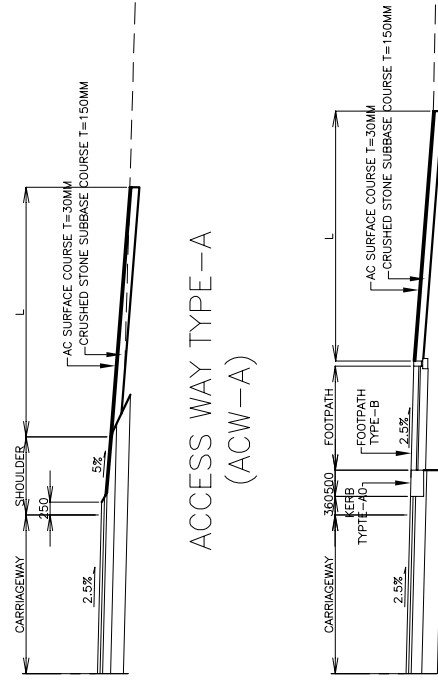


ACCESS WAY TYPE -A, C & E

PLAN

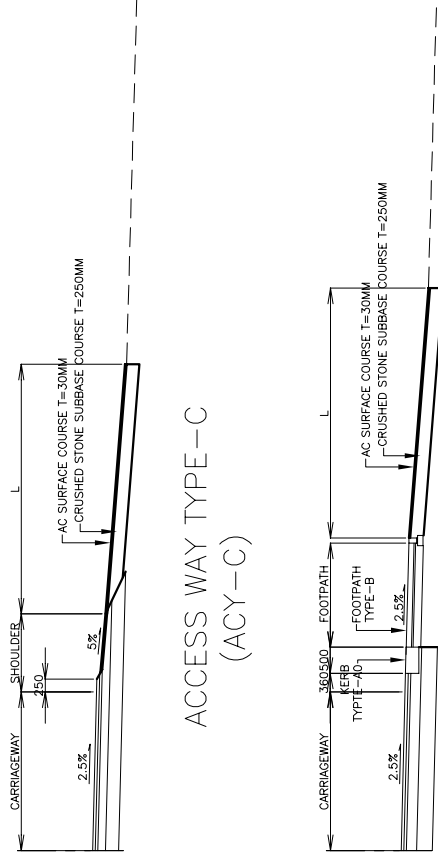
ACCESS WAY TYPE -B, D & F

PLAN



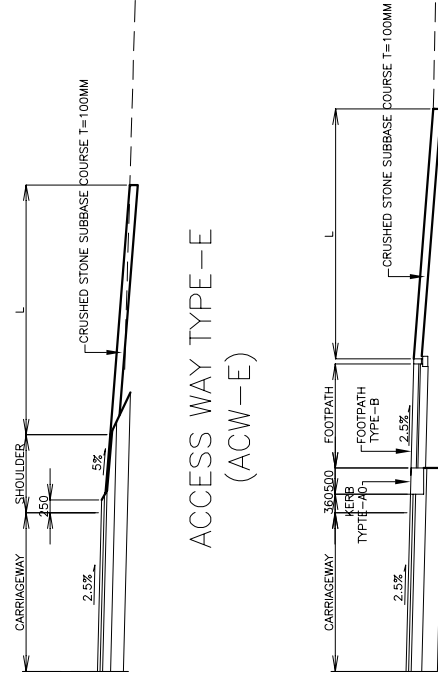
ACCESS WAY TYPE -A
(ACW-A)

ACCESS WAY TYPE -B
(ACW-B)



ACCESS WAY TYPE -C
(ACY-C)

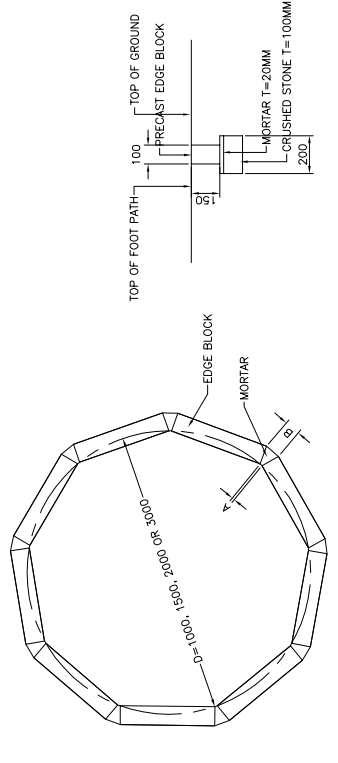
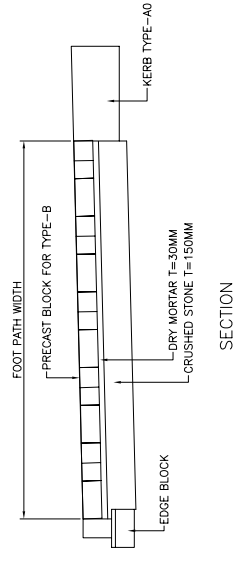
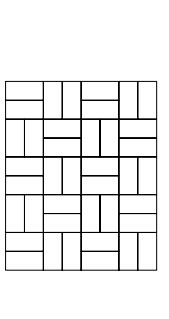
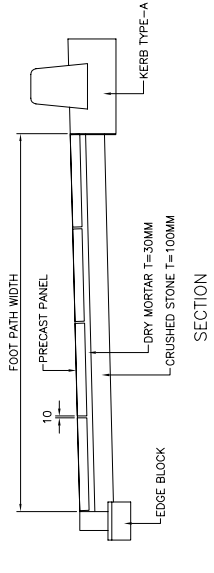
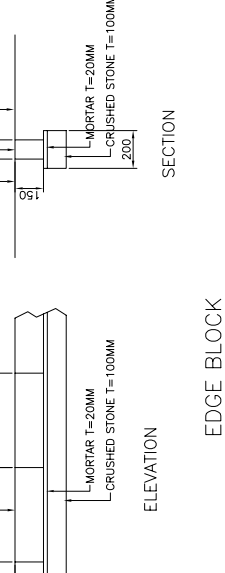
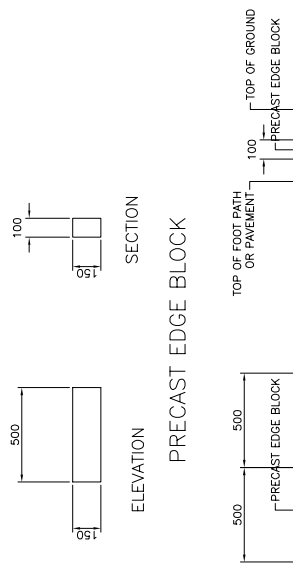
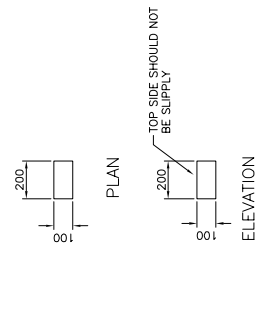
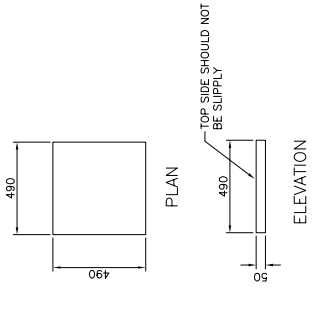
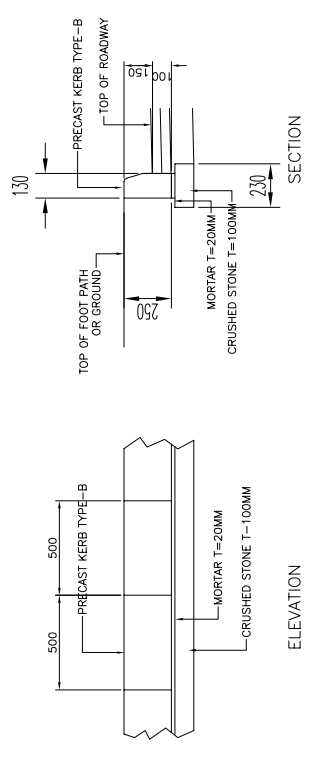
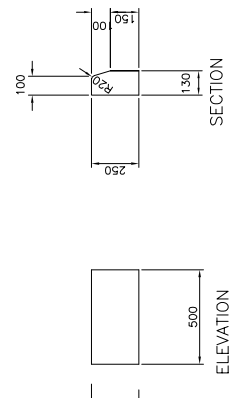
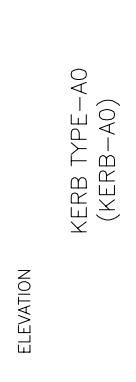
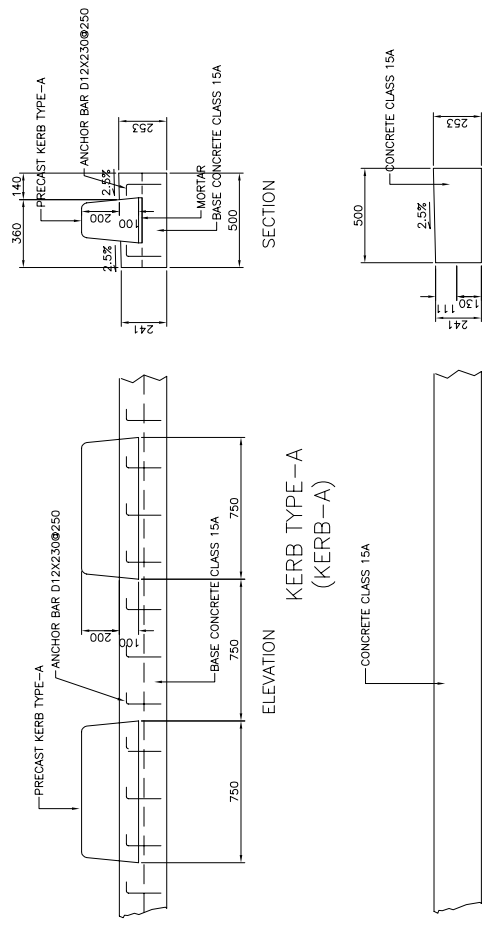
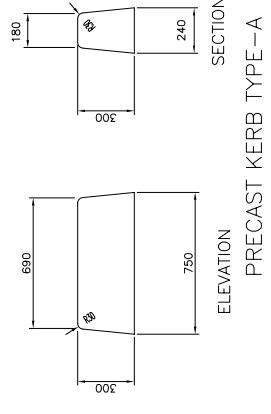
ACCESS WAY TYPE -D
(ACW-D)



ACCESS WAY TYPE -E
(ACW-E)

ACCESS WAY TYPE -F
(ACW-F)

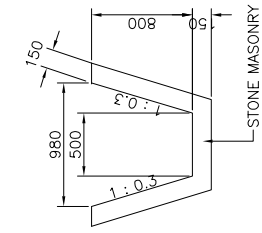
MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA	BASIC DESIGN FOR THE PROJECT FOR IMPROVEMENT AND MAINTENANCE OF NDOLA AND KITWE CITY ROADS IN THE REPUBLIC OF ZAMBIA	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	ACCESS WAYS	SCALE	APPROVED DATE	KATAHIRA & ENGINEERS INTERNATIONAL JAPAN ENGINEERING CONSULTANTS	PREPARED CHECKED	DATE	SHEET NO
				S=1:100			SUBMITTED		



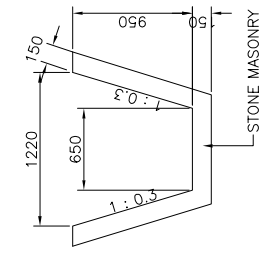
D	NO. OF EDGE BLOCKS	A	B
1000	6	0	100
1500	9	13	81
2000	12	18	44
3000	18	21	38

NOTE:
1. MATERIALS FOR THE PRECAST ITEMS SHALL BE IN ACCORDANCE WITH THE TECHNICAL SPECIFICATIONS.
2. ELASTIC EXPANSION JOINT (T=10MM) SHALL BE INSTALLED AT EVERY 10M INTERVAL.

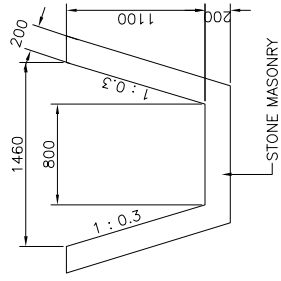
MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA	BASIC DESIGN FOR THE PROJECT FOR IMPROVEMENT AND MAINTENANCE OF NDOLA AND KITWE CITY ROADS IN THE REPUBLIC OF ZAMBIA	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	ROAD STRUCTURE DETAIL		SCALE S=1:20	APPROVED	PREPARED CHECKED	DATE	SHEET NO RD-1
			KERBS, FOOTPATHS EDGE BLOCKS, TREE CIRCLE			DATE	SUBMITTED		
							KATAHIRA & ENGINEERS INTERNATIONAL JAPAN ENGINEERING CONSULTANTS		



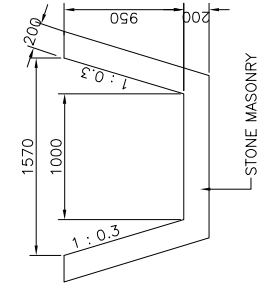
DM-500



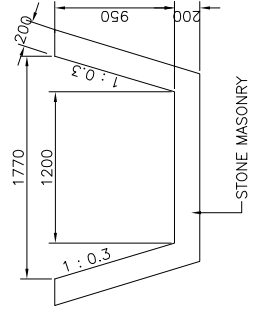
DM-650



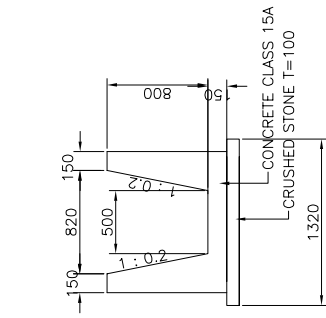
DM-800



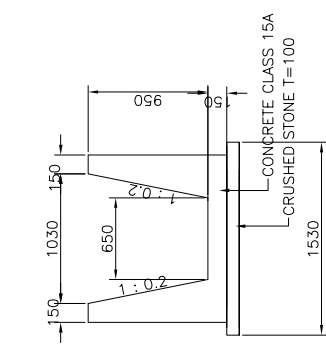
DM-1000



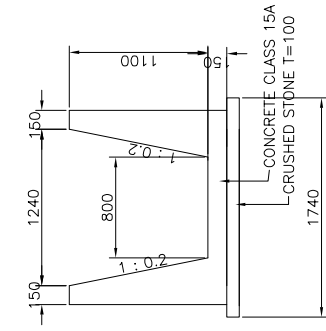
DM-1200-L



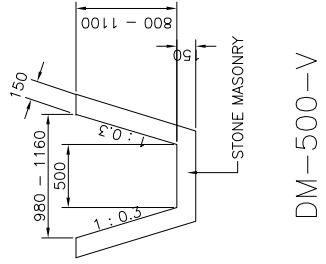
DC-500



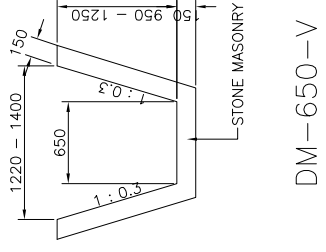
DC-650



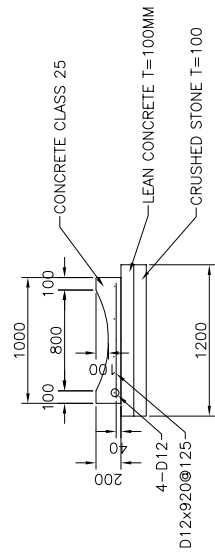
DC-800



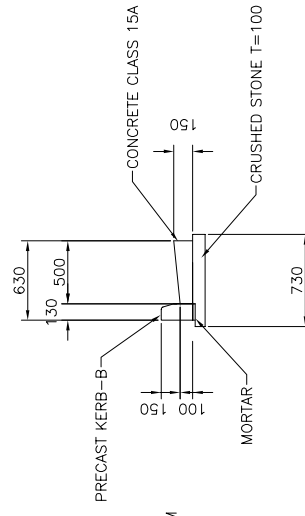
DM-500-V



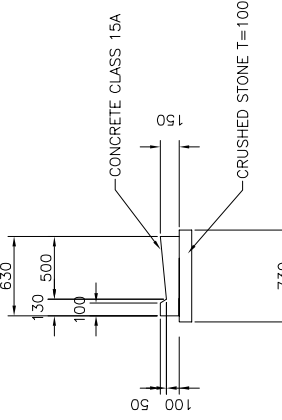
DM-650-V



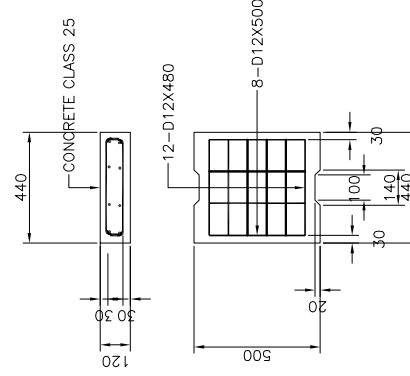
ROLLED GUTTER
DG-R



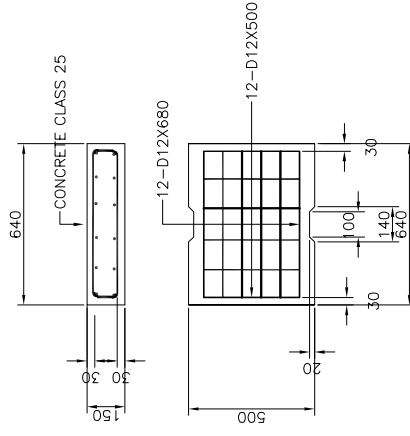
GUTTER DITCH
DG-L



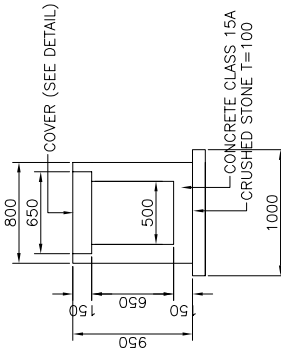
GUTTER DITCH
DG-LS



DC-300-C

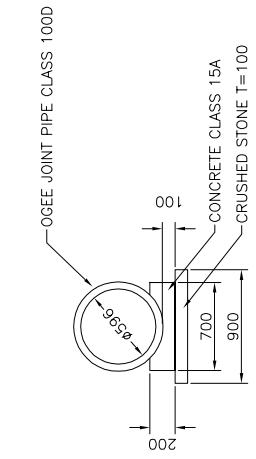


DC-500-C

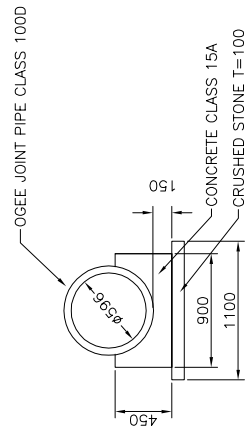


NOTE:
1. ELASTIC EXPANSION JOINT SHALL BE INSTALLED FOR CONCRETE DITCHES AT LESS THAN 10.M INTERVAL.
2. SURFACE OF THE MASONRY DITCHES SHALL BE ROUGH WHERE GRADE IS STEEPER THAN 2%.

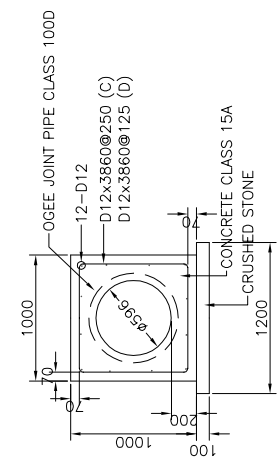
MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA	BASIC DESIGN FOR THE PROJECT FOR IMPROVEMENT AND MAINTENANCE OF NDOLA AND KITWE CITY ROADS IN THE REPUBLIC OF ZAMBIA	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	DRAINAGE STRUCTURE DETAIL		APPROVED DATE	KATAHIRA & ENGINEERS INTERNATIONAL JAPAN ENGINEERING CONSULTANTS	PREPARED CHECKED SUBMITTED	DATE	SHEET NO DR-1
			DRAINAGE DITCHES						



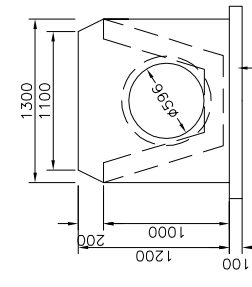
DP-600A



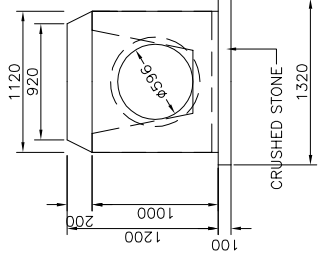
DP-600B



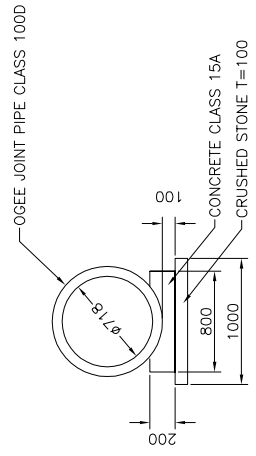
DP-600C & D



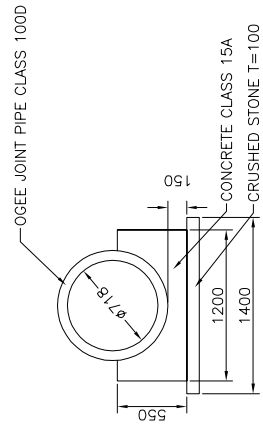
HWM-600



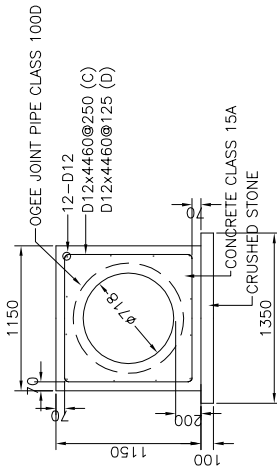
HWC-600



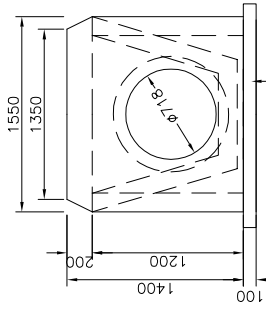
DP-750A



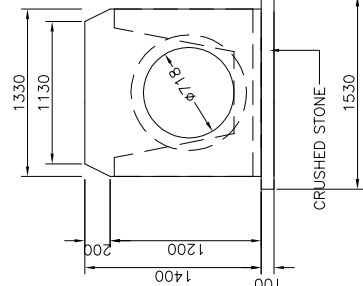
DP-750B



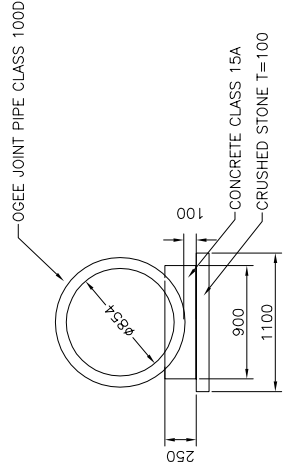
DP-750C & D



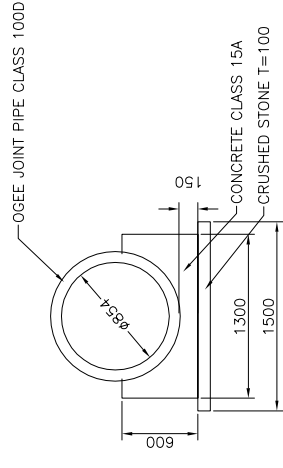
HWM-750



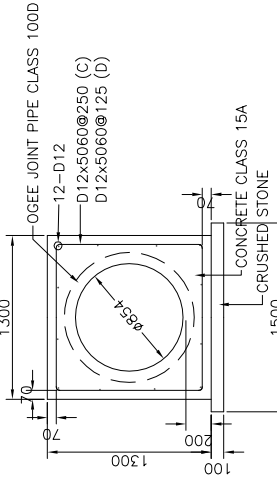
HWC-750



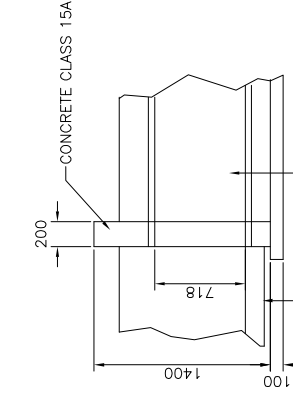
DP-900A



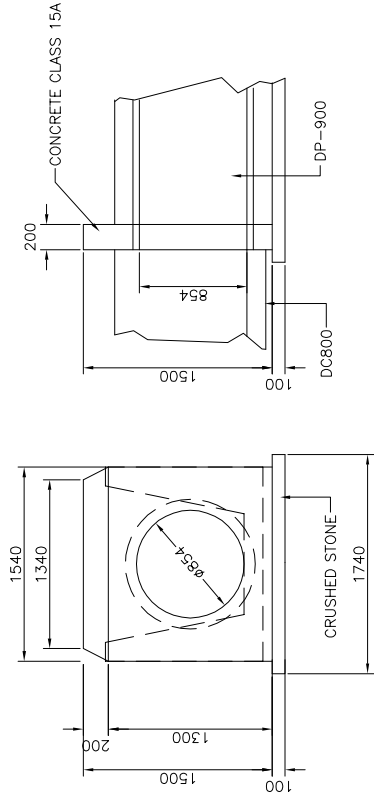
DP-900B



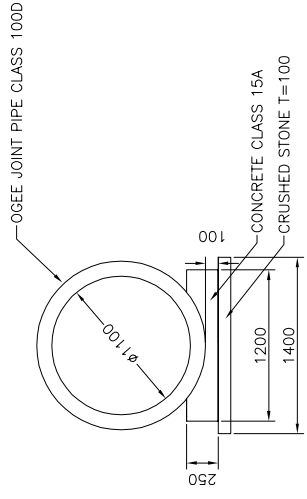
DP-900C & D



HWM-900

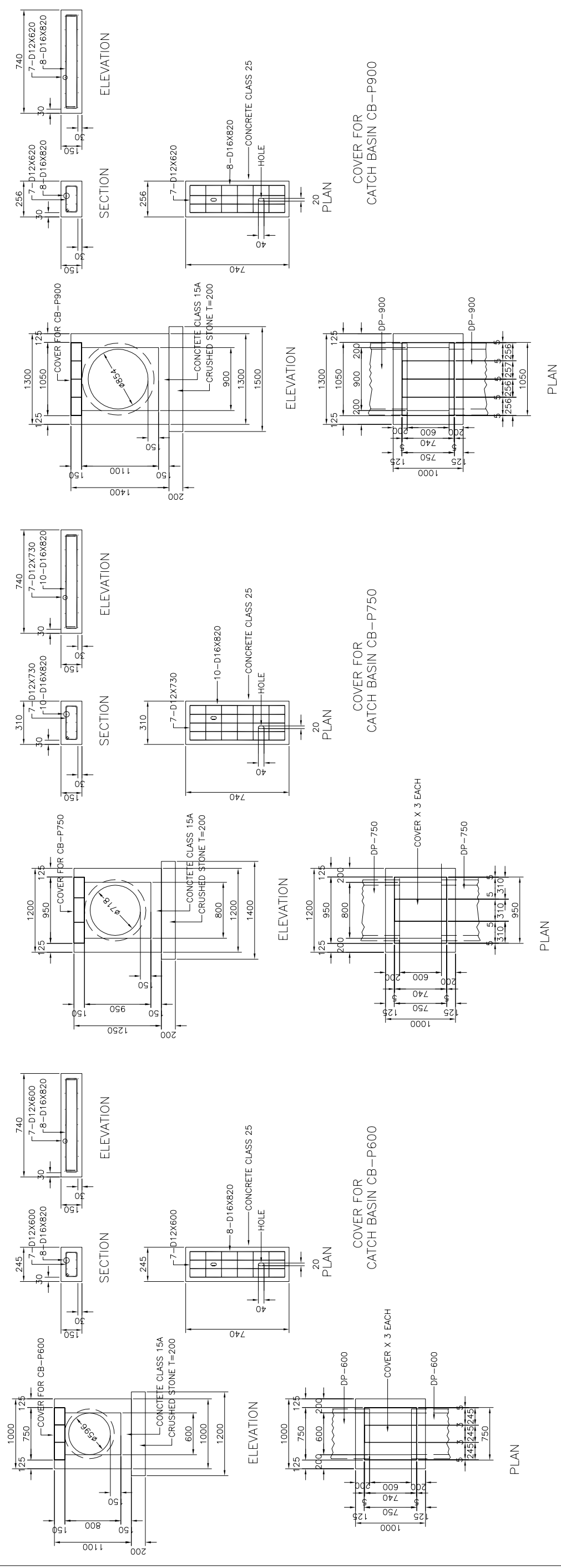


HWC-900



DP-1200A

MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA	BASIC DESIGN FOR THE PROJECT FOR IMPROVEMENT AND MAINTENANCE OF NDOLA AND KITWE CITY ROADS IN THE REPUBLIC OF ZAMBIA	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)		DRAINAGE STRUCTURE DETAIL		SCALE	APPROVED	KATAHIRA & ENGINEERS INTERNATIONAL JAPAN ENGINEERING CONSULTANTS	PREPARED CHECKED	DATE	SHEET NO
		DRAINAGE PIPES		S=1:30	DATE	SUBMITTED			DR-2		

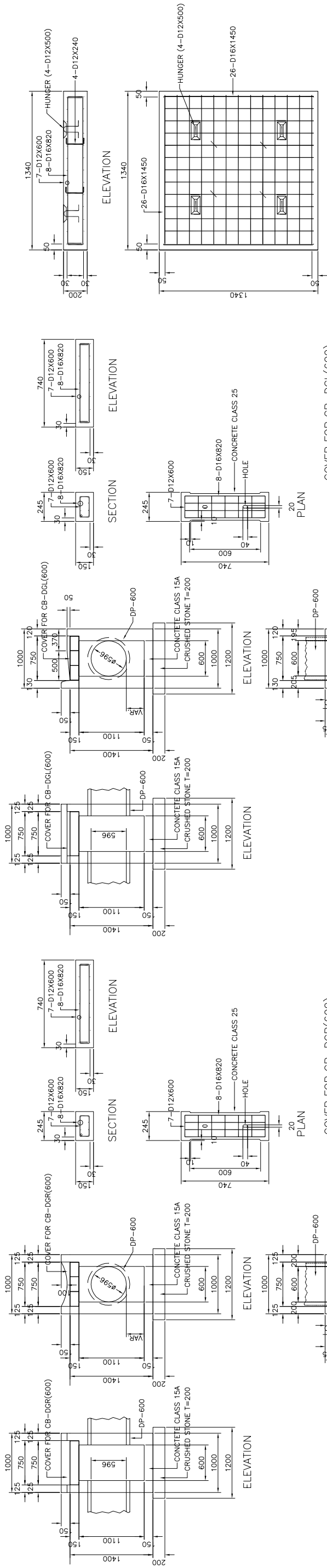


CATCH BASIN
CB-P600

CATCH BASIN
CB-P750

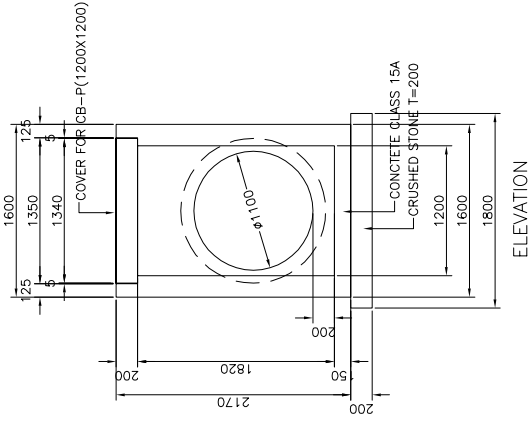
CATCH BASIN
CB-P900

MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA	BASIC DESIGN FOR THE PROJECT FOR IMPROVEMENT AND MAINTENANCE OF NDOLA AND KITWE CITY ROADS IN THE REPUBLIC OF ZAMBIA	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	DRAINAGE STRUCTURE DETAIL CATCH BASINS (1)	SCALE	APPROVED	KATAHIRA & ENGINEERS INTERNATIONAL JAPAN ENGINEERING CONSULTANTS	PREPARED CHECKED	DATE	SHEET NO
				S=1:30	DATE		SUBMITTED	DR-3	



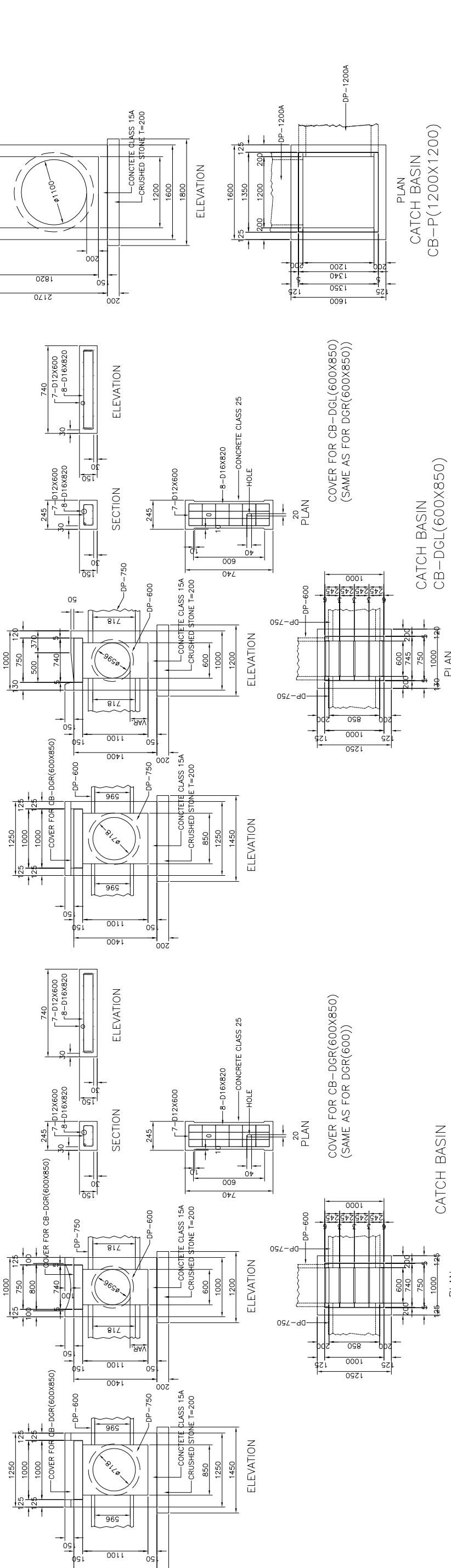
COVER FOR CB-DGR(600)
(SAME AS FOR CB-DGR(600))

CATCH BASIN
CB-DGL(600)



COVER FOR CB-P(1200X1200)

CATCH BASIN
CB-DGL(600X850)

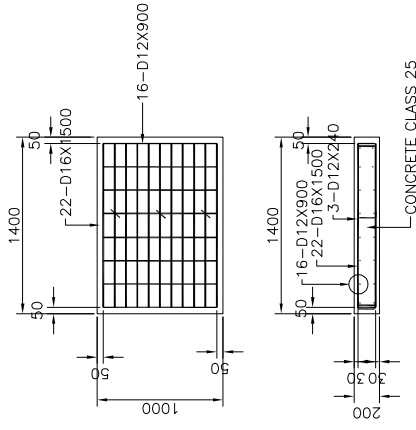


COVER FOR CB-DGL(600X850)
(SAME AS FOR DGR(600X850))

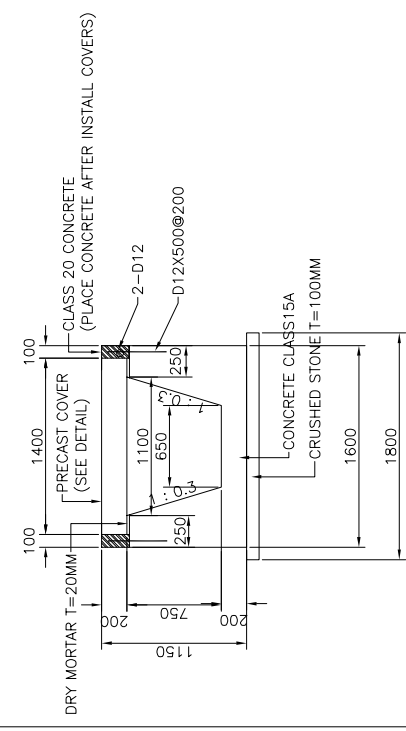
CATCH BASIN
CB-DGL(600X850)

CATCH BASIN
CB-P(1200X1200)

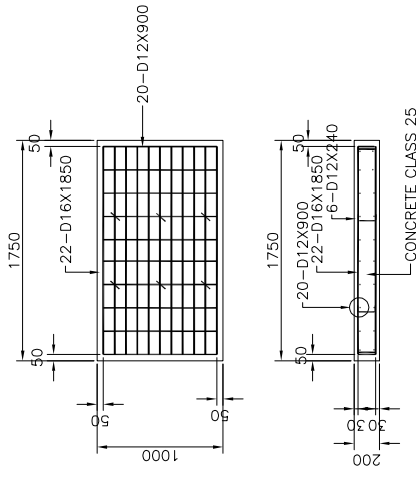
MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA	BASIC DESIGN FOR THE PROJECT FOR IMPROVEMENT AND MAINTENANCE OF NDOLA AND KITWE CITY ROADS IN THE REPUBLIC OF ZAMBIA	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	DRAINAGE STRUCTURE DETAIL CATCH BASINS (2)	SCALE S=1:35	APPROVED	KATAHIRA & ENGINEERS INTERNATIONAL JAPAN ENGINEERING CONSULTANTS	PREPARED CHECKED	DATE	SHEET NO DR-4
					DATE		SUBMITTED		



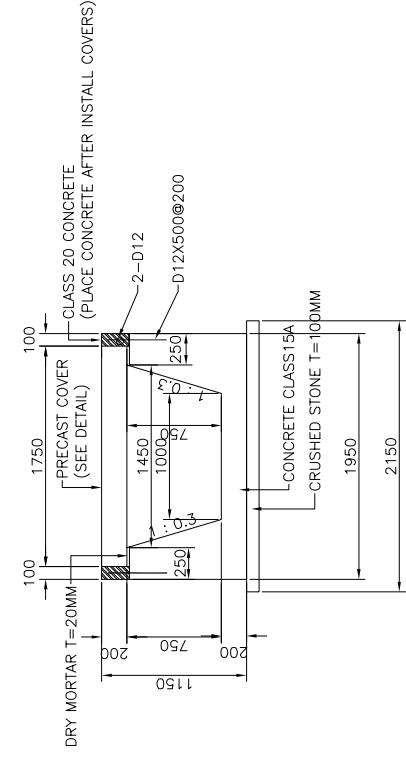
PRECAST COVER



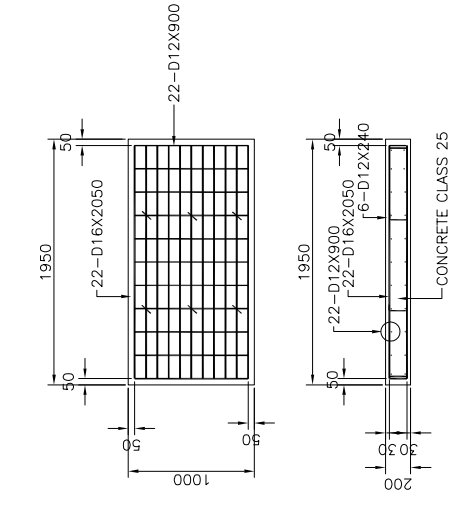
DC-650-C



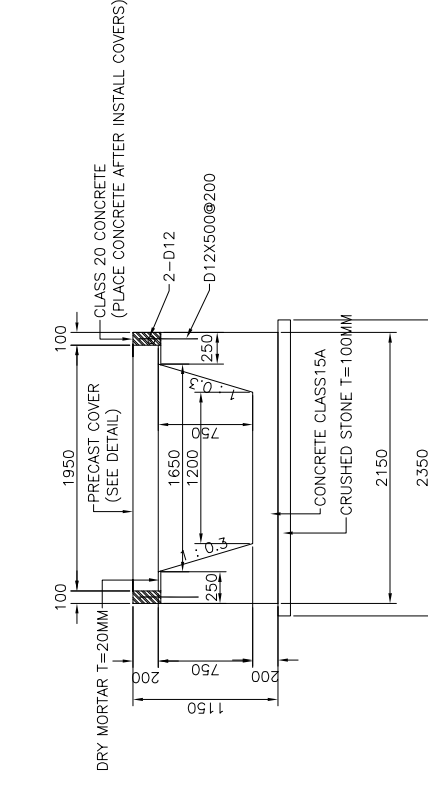
PRECAST COVER



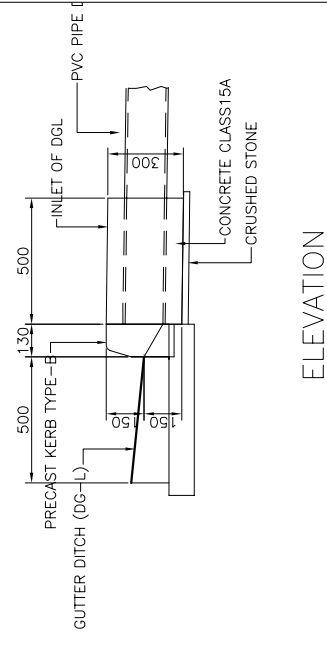
DC-1000-C



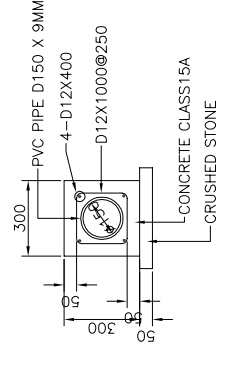
PRECAST COVER



DC-1200L-C

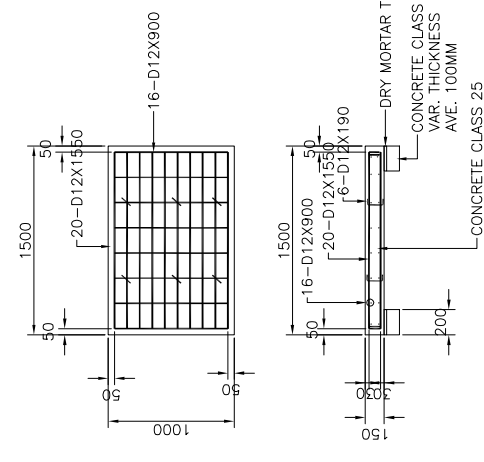


ELEVATION

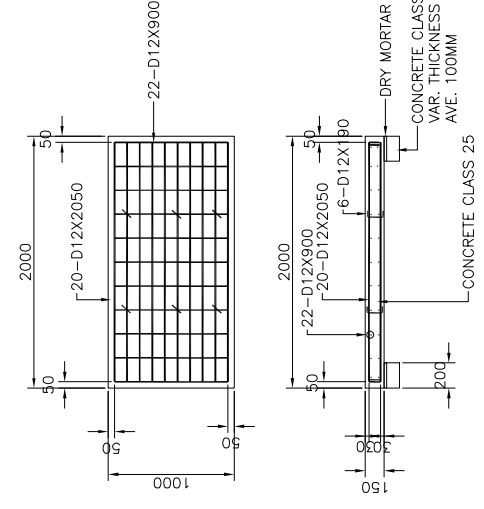


SECTION

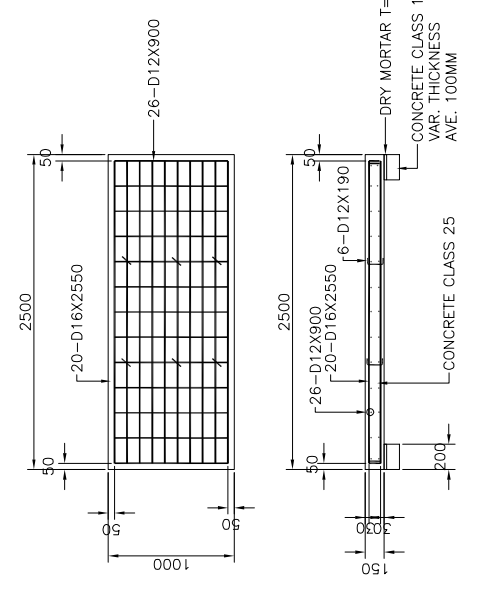
INLET-DGL



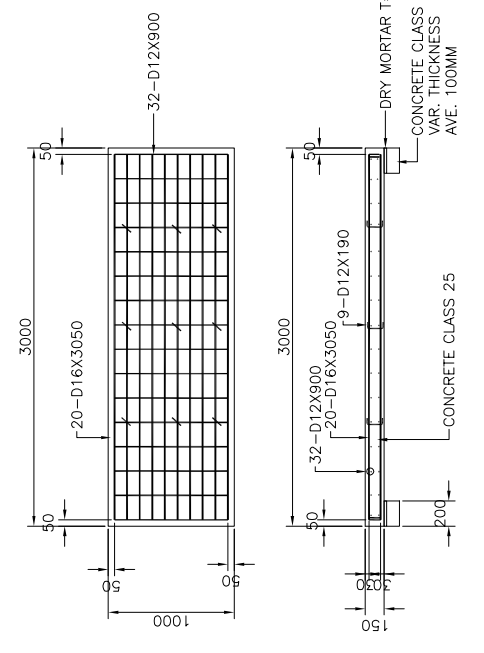
PRECAST SLAB (SLAB-1500)



PRECAST SLAB (SLAB-2000)

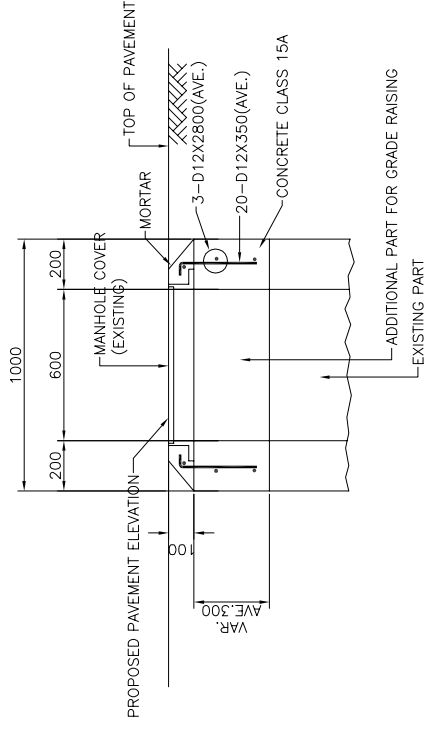
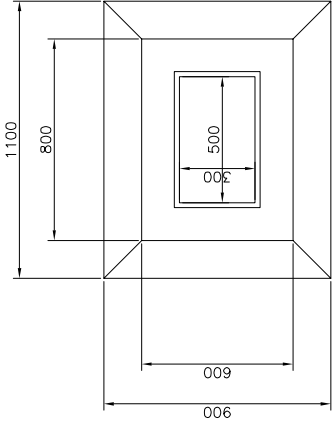
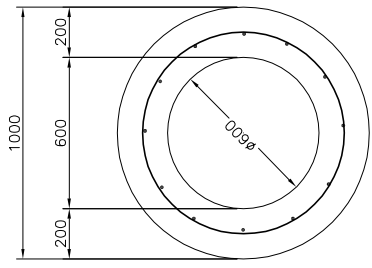


PRECAST SLAB (SLAB-2500)

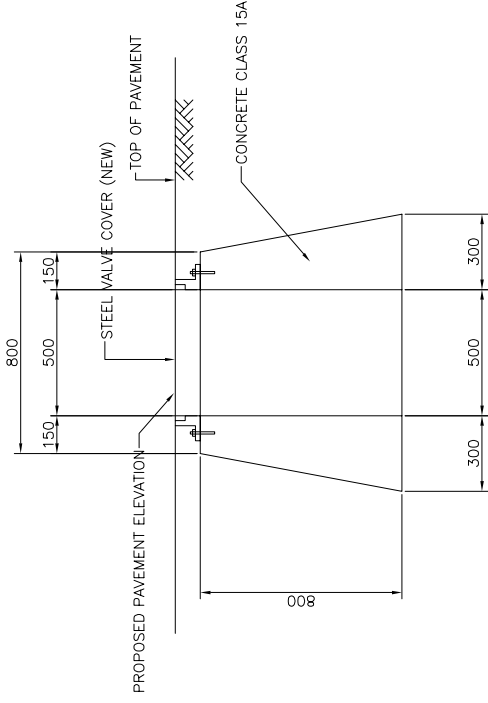


PRECAST SLAB (SLAB-3000)

MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA	BASIC DESIGN FOR THE PROJECT FOR IMPROVEMENT AND MAINTENANCE OF NDOLA AND KITWE CITY ROADS IN THE REPUBLIC OF ZAMBIA	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)		SCALE S=1:30	APPROVED DATE	KATAHIRA & ENGINEERS INTERNATIONAL JAPAN ENGINEERING CONSULTANTS	PREPARED CHECKED	DATE	SHEET NO
							SUBMITTED		DR-5

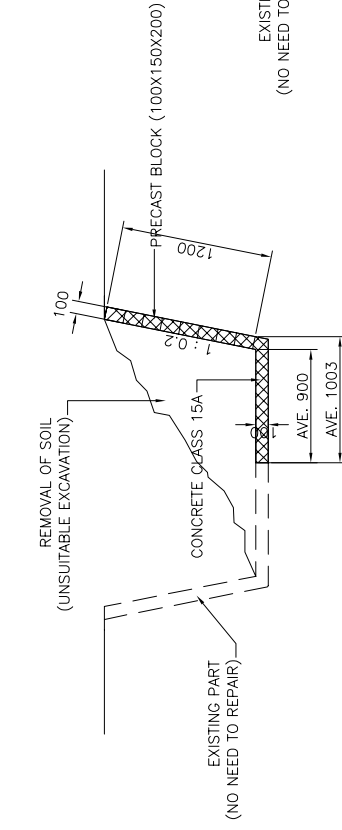


MANHOLE RAISE
(MH-RAISE)

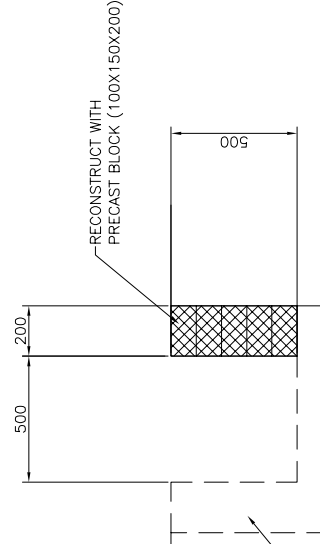


VALVE PROTECTOR
(VALVE)

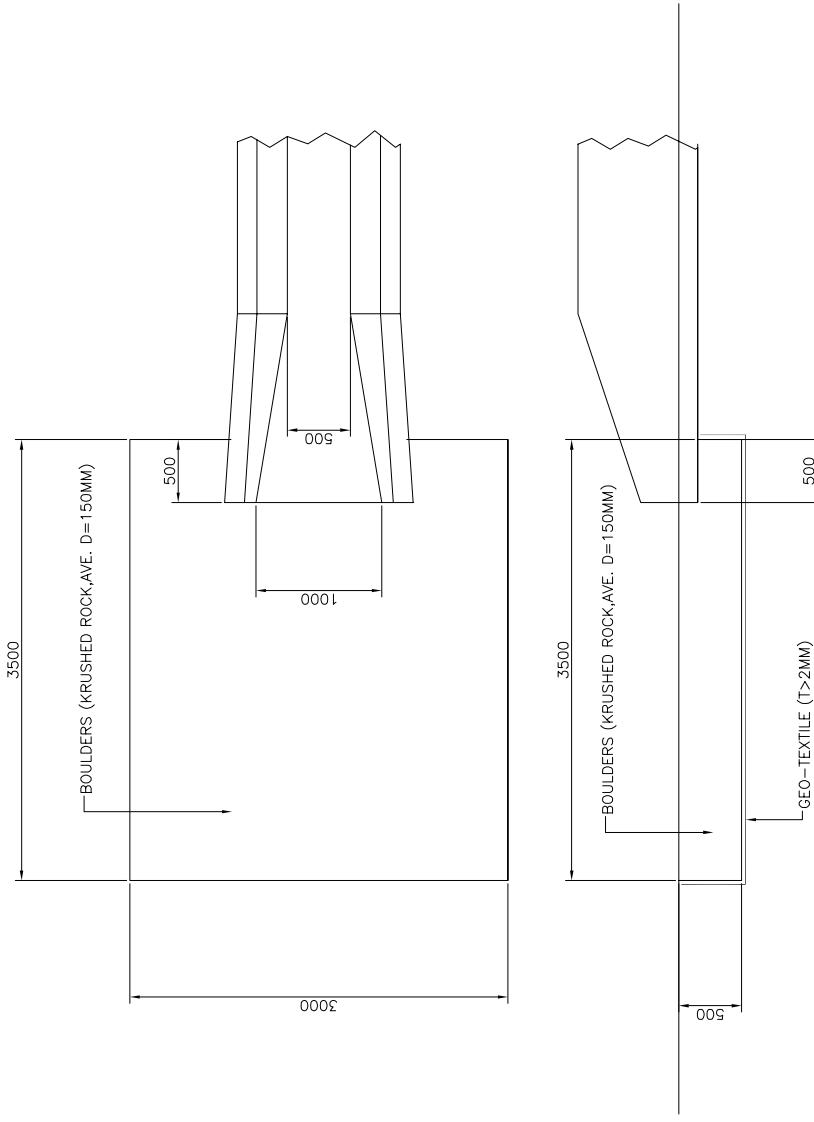
NOTE:
1. DRAWING SHOWS TYPICAL WORK OF MANHOLE RAISE AND VALVE PROTECTOR.
IT SHALL BE MODIFIED TO SUIT THE ACTUAL SITE CONDITION.



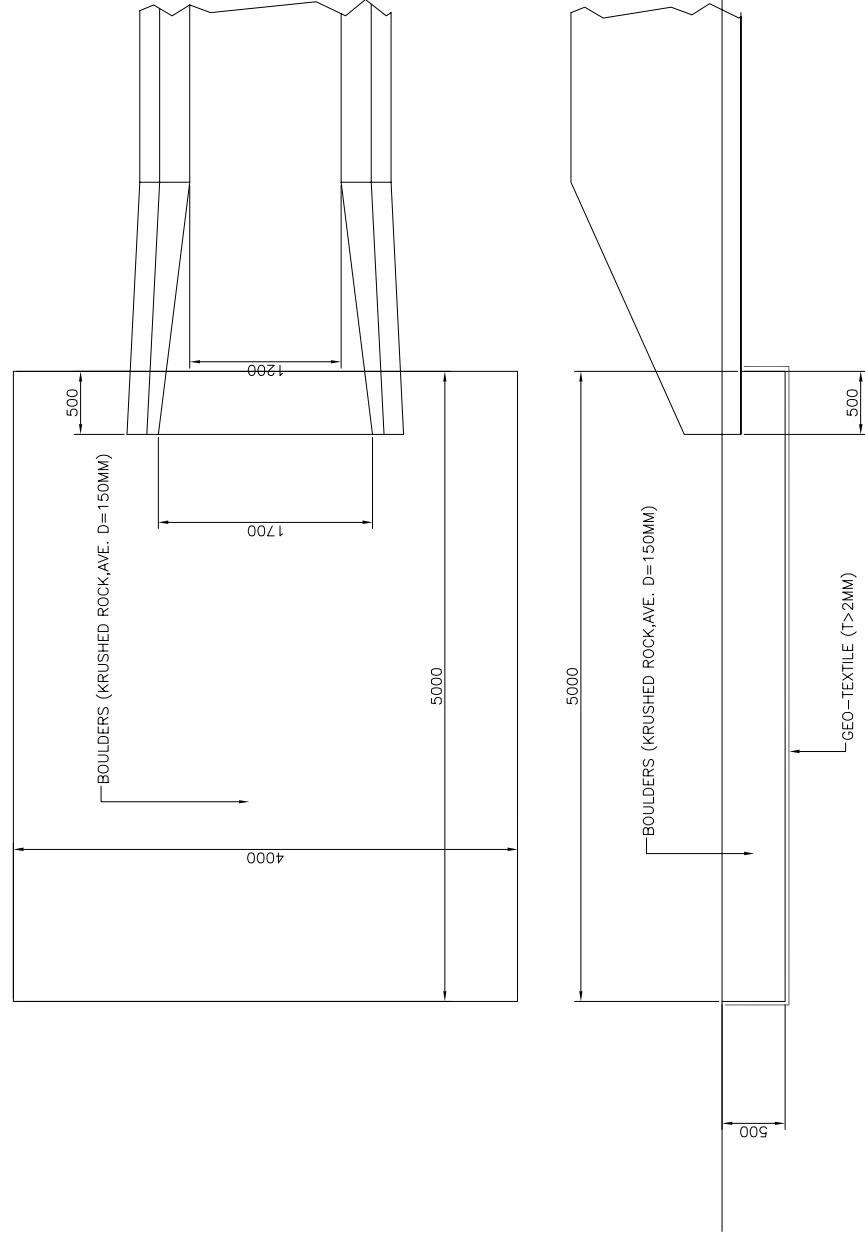
REPAIR DITCH
(REPAIR-D1200)



REPAIR DITCH
(REPAIR-D500)

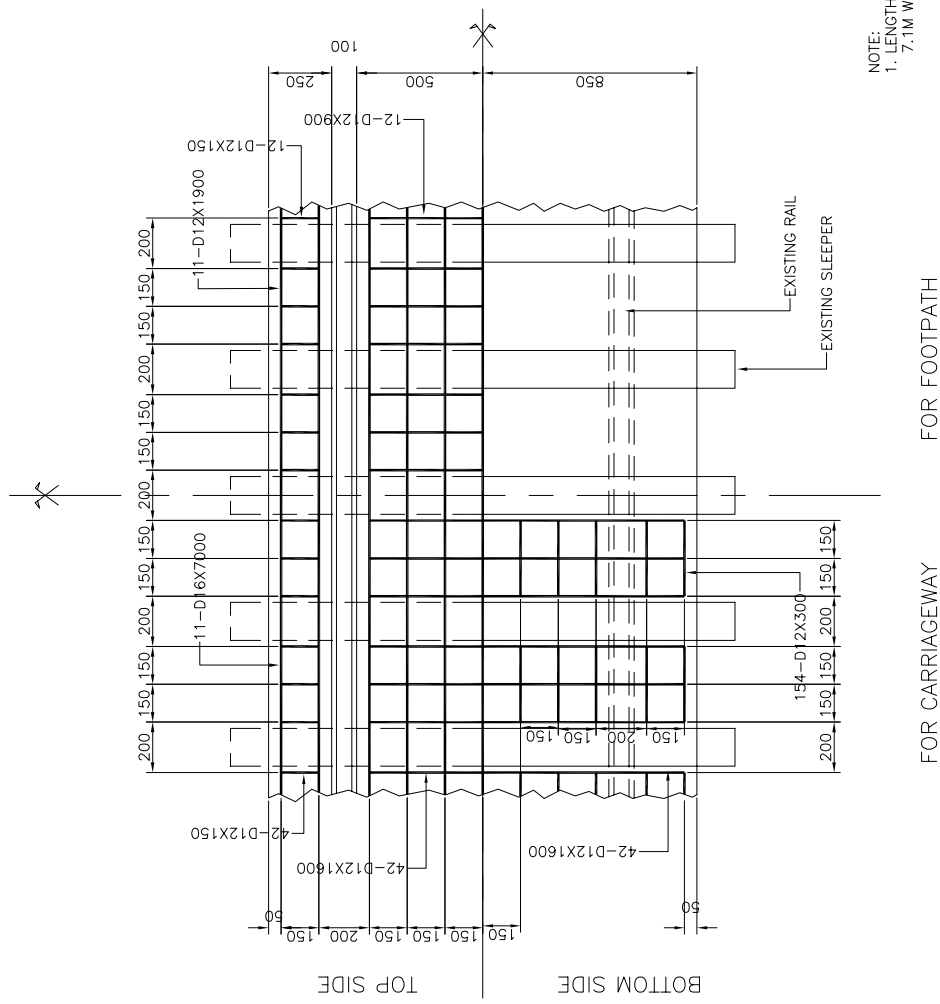
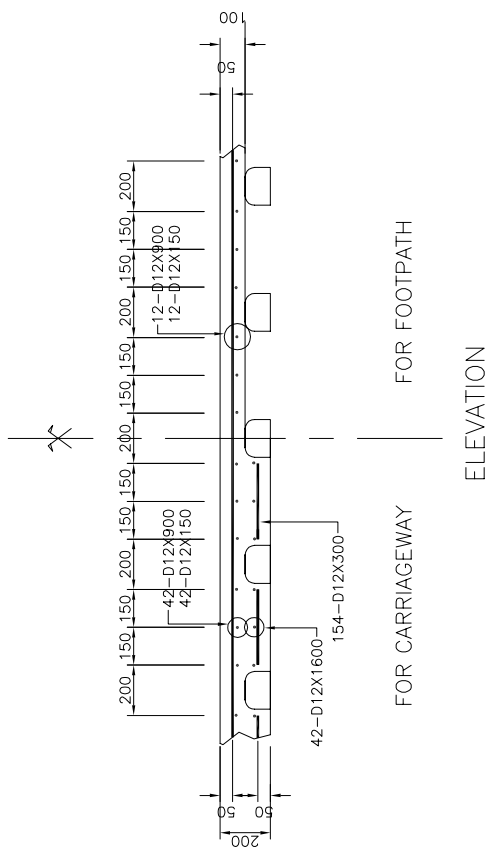
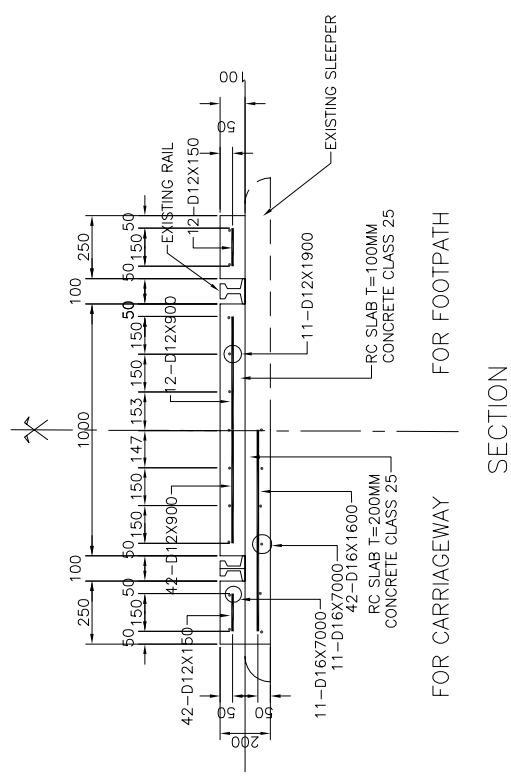


BOULDERS FOR DRAIN DISCHARGE
(BOULDERS-DIC-S)

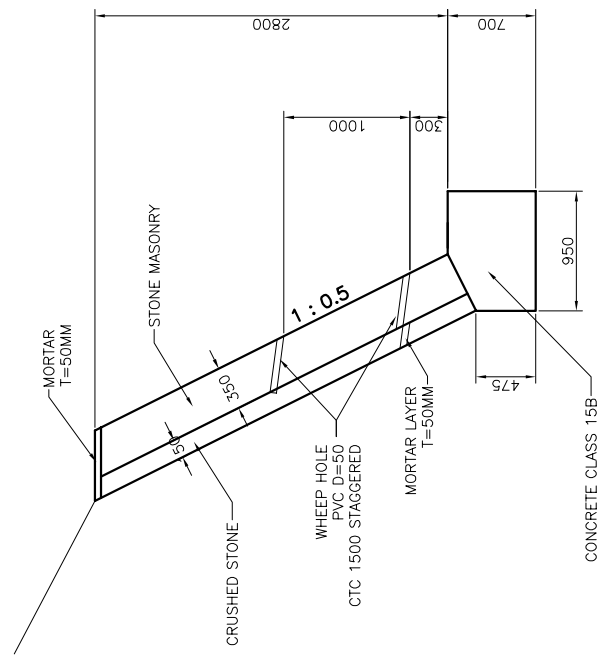


BOULDERS FOR DRAIN DISCHARGE
(BOULDERS-DIC-L)

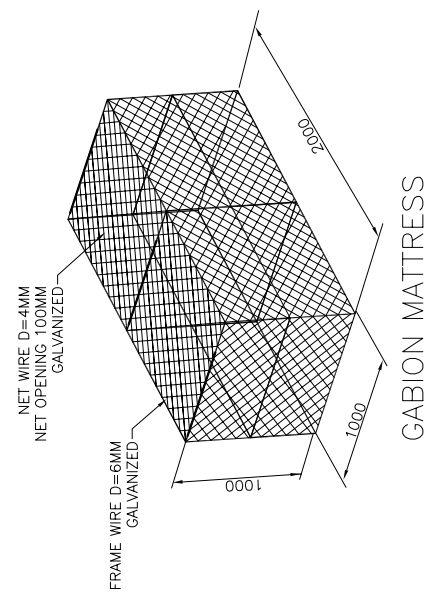
MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA	BASIC DESIGN FOR THE PROJECT FOR IMPROVEMENT AND MAINTENANCE OF NDOLA AND KITWE CITY ROADS IN THE REPUBLIC OF ZAMBIA	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	DRAINAGE STRUCTURE DETAIL MANHOLE RAISE, DITCH REPAIR & BOULDERS FOR DISCHARGE	SCALE	APPROVED	DATE	PREPARED CHECKED	DATE	SHEET NO
				S=1:30					



NOTE:
1. LENGTHS OF THE STEEL REINFORCING BARS SHOWN ARE FOR THE CASE OF
7.1M WIDE CARRIAGEWAY AND 2.0M WIDE FOOTPATH.



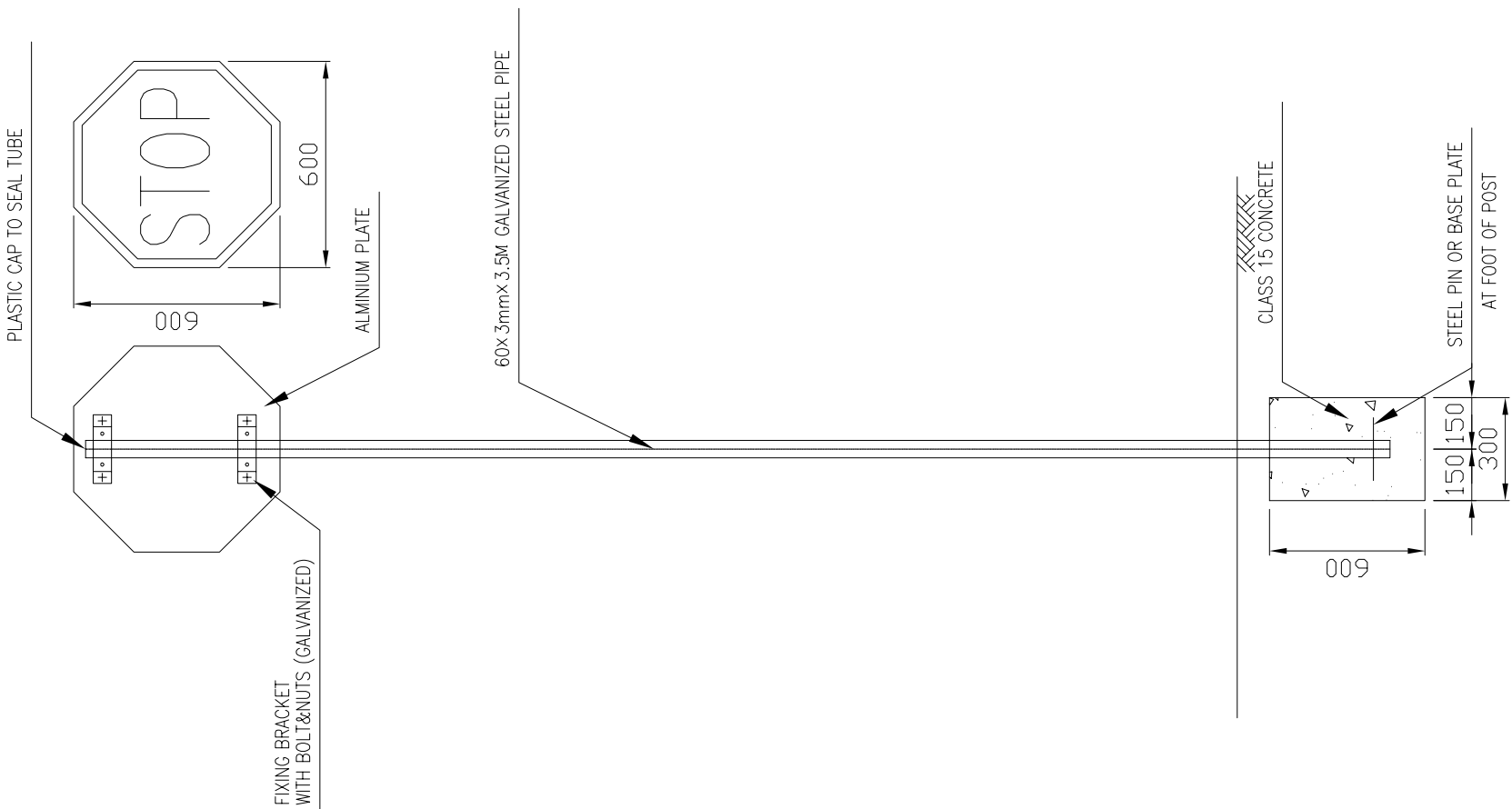
RETAINING WALL (H=2.8M)



GABION MATTRESS

SLAB FOR RAILWAY CROSSING

MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA	BASIC DESIGN FOR THE PROJECT FOR IMPROVEMENT AND MAINTENANCE OF NDOLA AND KITWE CITY ROADS IN THE REPUBLIC OF ZAMBIA	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	MISCELLANEOUS STRUCTURE DETAILS RETAINING WALL, GABION MATTRESS & RAILWAY CROSSING	SCALE S=1:30	APPROVED	KATAHIRA & ENGINEERS INTERNATIONAL JAPAN ENGINEERING CONSULTANTS	PREPARED CHECKED	DATE	SHEET NO MC-1
					DATE		SUBMITTED		

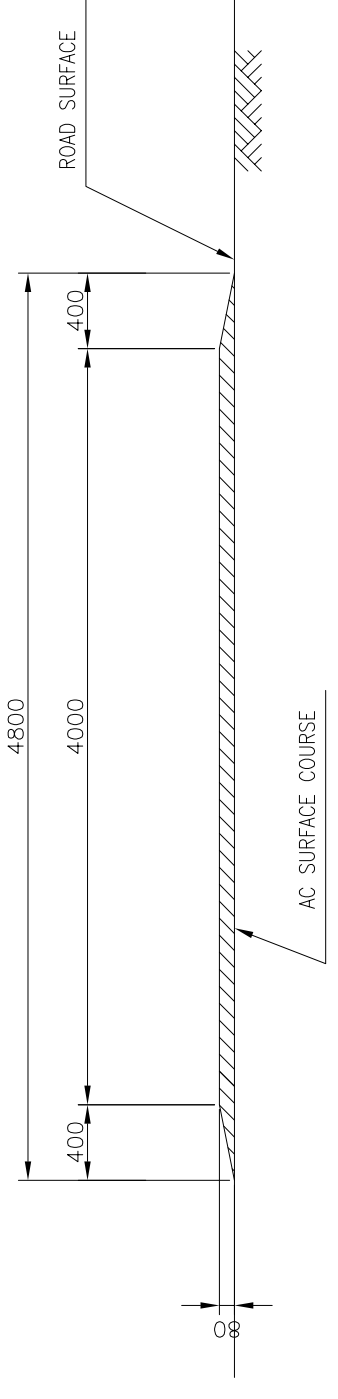
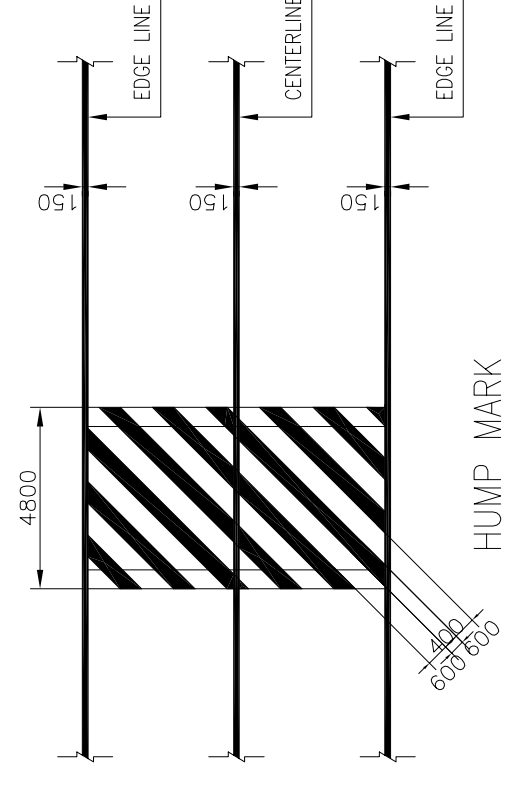
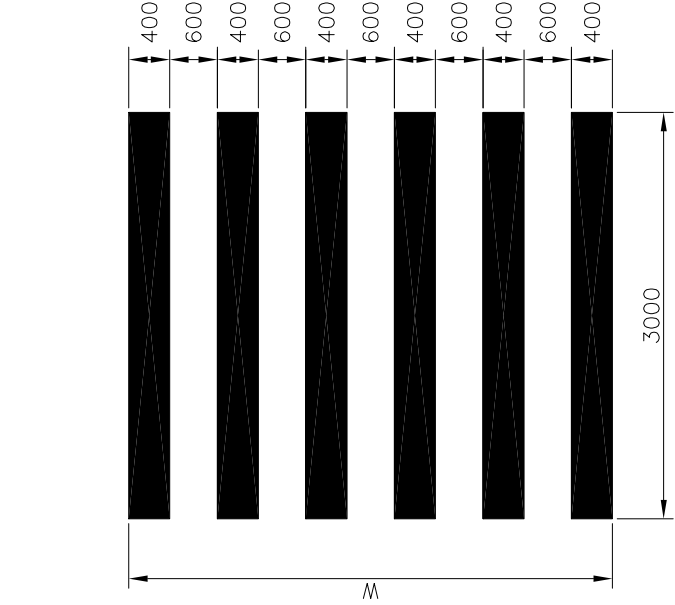
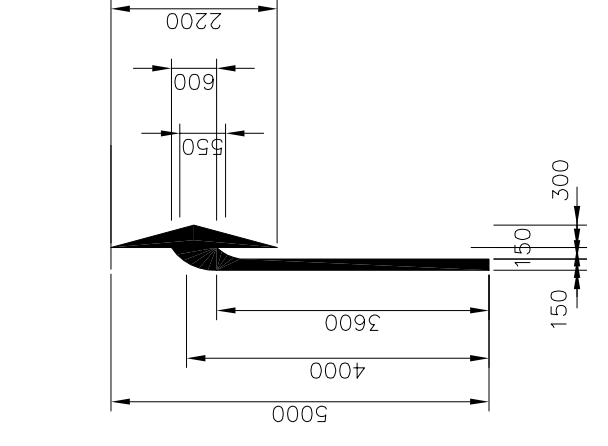
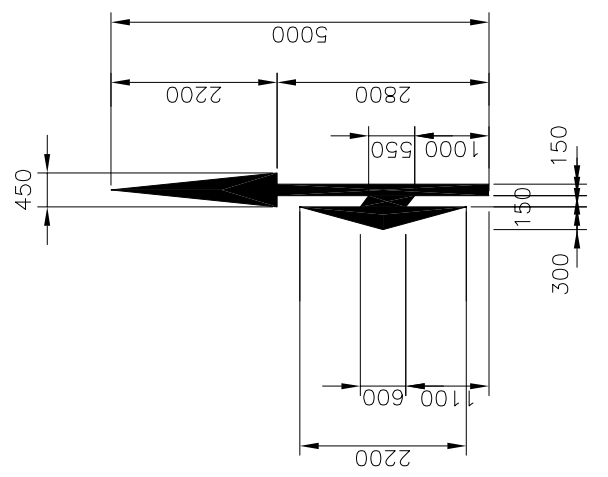
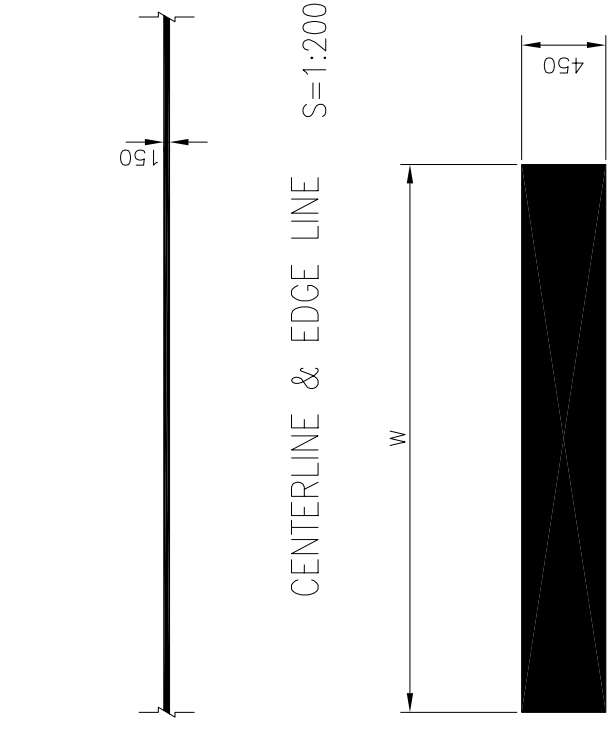


SIGN BOARD S=1:20

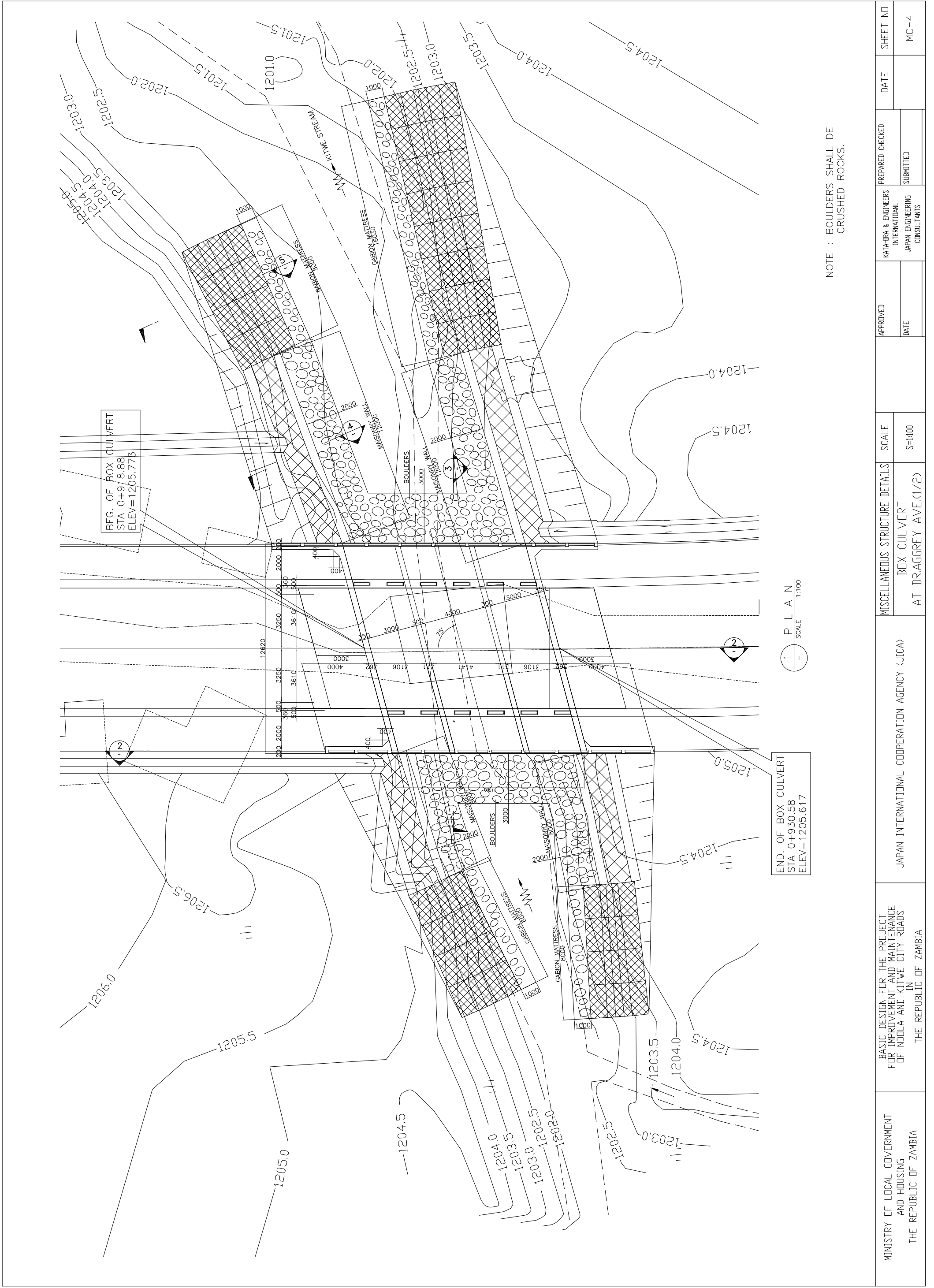
SIGN BOARD INSTALLATION SCHEDULE

TYPE OF SIGN BOARD	LOCATION OF SIGN BOARD									
STOP	N1: 0K000 (L)	N5: 1K270 (L)	N8: 2K915 (L)	K1: 0K540 (L)	K6: 0K355 (L)	K10: 0K905 (L)				
	N1: 0K480 (R)	N5: 1K515 (R)	N8: 3K190 (R)	K1: 0K680 (R)	K7: 0K005 (R)	K11: 0K005 (R)				
	N1: 0K490 (L)	N5: 2K230 (L)	N8: 3K545 (R)	K1: 0K680 (R)	K7: 0K320 (R)	K11: 0K720 (L)				
	N1: 0K825 (L)	N6: 0K010 (R)	N8: 3K610 (R)	K1: 0K695 (L)	K7: 0K400 (L)	K12: 0K010 (R)				
	N2: 0K010 (R)	N6: 0K012 (R)	N8: 3K880 (R)	K2: 0K130 (R)	K7: 0K630 (R)	K12: 0K700 (L)				
	N2: 0K140 (R)	N8: 0K095 (R)	N8: 3K895 (L)	K2: 0K140 (L)	K7: 0K850 (R)	K13: 0K400 (L)				
	N2: 0K280 (L)	N8: 0K585 (L)	N8: 4K080 (L)	K2: 0K395 (L)	K7: 0K975 (R)	K13: 0K615 (L)				
	N3: 0K240 (R)	N8: 0K630 (R)	N8: 4K150 (R)	K2: 0K470 (R)	K7: 1K320 (R)	K14: 0K000 (R)				
	N3: 0K870 (L)	N8: 0K895 (R)	N8: 4K385 (R)	K2: 0K580 (L)	K7: 1K675 (R)	K14: 0K345 (R)				
	N4: 0K005 (R)	N8: 1K050 (R)	N8: 4K650 (L)	K3: 0K010 (R)	K7: 2K030 (R)	K14: 0K405 (R)				
	N4: 0K275 (R)	N8: 1K310 (R)	N9: 0K005 (R)	K3: 0K240 (L)	K7: 2K365 (L)	K14: 0K835 (R)				
	N4: 0K285 (L)	N8: 1K335 (L)	N9: 0K070 (R)	K3: 0K365 (L)	K8: 0K000 (R)	-				
	N4: 0K530 (L)	N8: 1K555 (L)	N9: 0K110 (L)	K4: 0K015 (R)	K8: 0K360 (R)	-				
	N4: 0K565 (R)	N8: 1K720 (R)	N9: 0K125 (R)	K4: 0K140 (R)	K8: 0K455 (L)	-				
N4: 1K195 (R)	N8: 2K000 (R)	N9: 0K215 (R)	K4: 0K420 (L)	K8: 0K665 (R)	-					
N4: 1K210 (L)	N8: 2K045 (L)	N9: 0K285 (R)	K4: 0K450 (R)	K8: 0K675 (L)	-					
N4: 1K690 (L)	N8: 2K145 (R)	N9: 0K015 (L)	K5: 0K180 (L)	K8: 0K995 (L)	-					
N5: 0K195 (L)	N8: 2K245 (R)	N1: 0K015 (R)	K5: 0K340 (L)	K9: 0K515 (L)	-					
N5: 0K370 (R)	N8: 2K785 (R)	K1: 0K140 (R)	K6: 0K015 (R)	K10: 0K005 (R)	-					
N5: 1K000 (R)	N8: 2K860 (R)	K1: 0K270 (R)	K6: 0K190 (L)	K10: 0K220 (R)	-					
CROSSWALK AHEAD	N1: 0K460 (L)	N3: 0K265 (R)	N4: 0K970 (R)	N6: 0K260 (L)	K1: 0K005 (L)	-				
	N1: 0K500 (L)	N4: 0K555 (L)	N6: 0K040 (L)	N7: 0K010 (R)	K4: 0K425 (R)	-				
	N2: 0K000 (L)	N4: 0K840 (L)	N6: 0K045 (R)	N7: 0K230 (R)	K4: 0K435 (L)	-				
	N2: 0K285 (R)	N4: 0K845 (R)	N6: 0K160 (R)	N7: 0K380 (R)	K4: 0K570 (L)	-				
INTERSECTION AHEAD	N3: 0K225 (L)	N4: 0K965 (L)	N6: 0K165 (L)	K1: 0K005 (R)	-					
	N4: 0K540 (R)	N4: 1K220 (R)	K1: 0K520 (L)	-	-					
SHARP CURVE AHEAD	N4: 1K180 (L)	N4: 1K905 (R)	K1: 0K715 (R)	-	-					
	N3: 0K010 (L)	N7: 0K600 (R)	K11: 0K205 (L)	-	-					
HUMP AHEAD	N7: 0K520 (L)	N9: 0K240 (L)	K11: 0K300 (R)	-	-					
	N4: 1K000 (L)	N4: 1K405 (R)	N8: 2K190 (L)	K7: 0K500 (R)	K7: 1K530 (L)					
	N4: 1K005 (R)	N8: 1K700 (L)	N8: 2K200 (R)	K7: 1K180 (L)	K7: 2K210 (L)					
	N4: 1K340 (L)	N8: 1K710 (R)	K7: 0K495 (L)	K7: 1K190 (R)	K7: 2K220 (R)					
HEAVY VEHICLE NO ENTRY	N2: 0K000 (L)	N4: 0K525 (R)	N4: 1K070 (R)	N4: 1K685 (R)	-					
	N2: 0K140 (R)	N4: 0K570 (L)	N4: 1K230 (L)	-	-					

MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA	BASIC DESIGN FOR THE PROJECT FOR IMPROVEMENT AND MAINTENANCE OF NDOLA AND KITWE CITY ROADS IN THE REPUBLIC OF ZAMBIA	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	MISCELLANEOUS STRUCTURE DETAILS		SIGN BOARDS		SCALE	S=1:20	APPROVED DATE	KATAHIRA & ENGINEERS INTERNATIONAL JAPAN ENGINEERING CONSULTANTS	PREPARED	CHECKED	DATE	SHEET NO
											SUBMITTED			MC-2

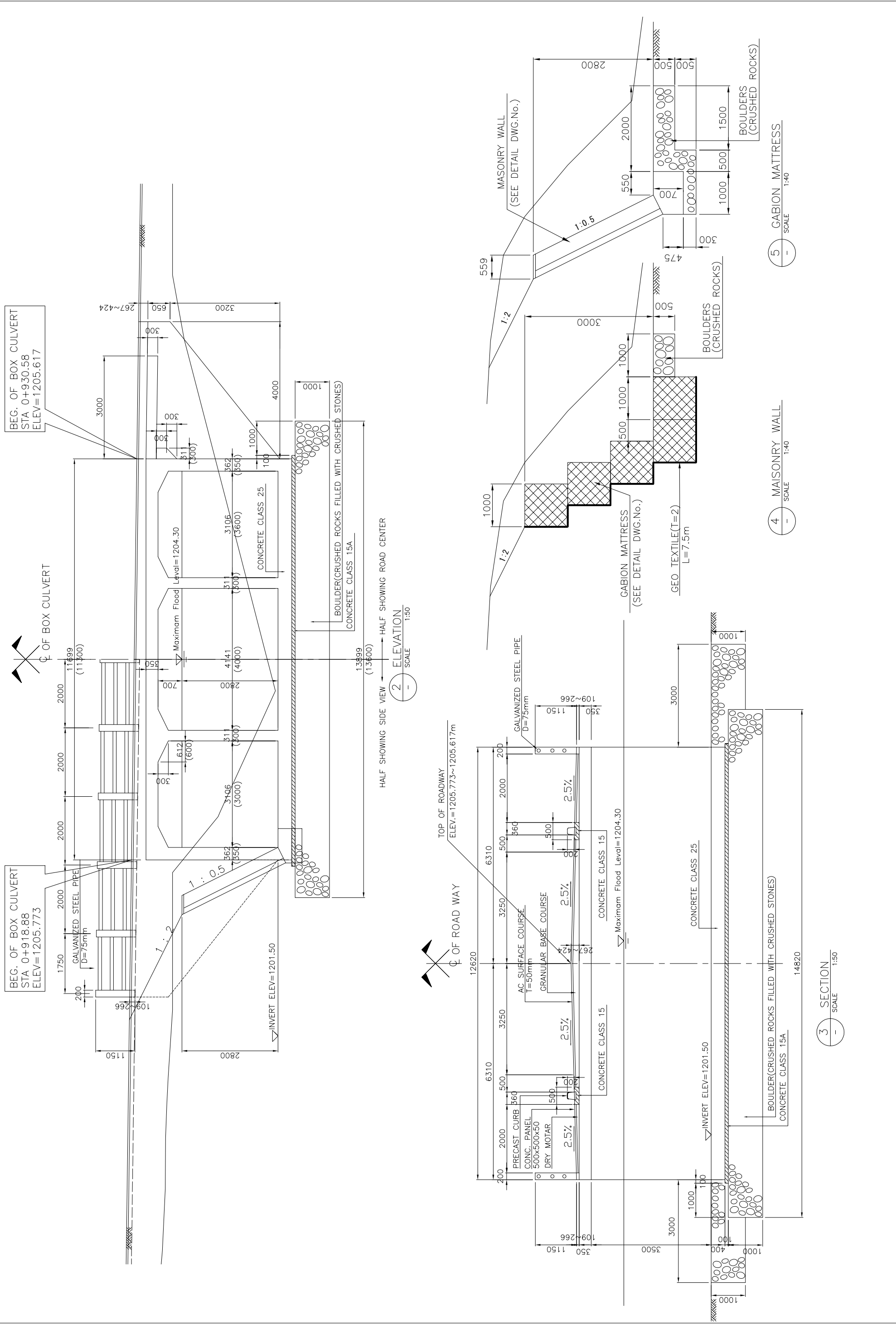


MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA	BASIC DESIGN FOR THE PROJECT FOR IMPROVEMENT AND MAINTENANCE OF NDOLA AND KITWE CITY ROADS IN THE REPUBLIC OF ZAMBIA	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)		MISCELLANEOUS STRUCTURE DETAILS ROAD MARKINGS , HUMPS		SCALE S=1:100	APPROVED DATE	KATAHIRA & ENGINEERS INTERNATIONAL JAPAN ENGINEERING CONSULTANTS	PREPARED CHECKED SUBMITTED	DATE	SHEET NO MC-3
		SECTION HUMP S=1:20									

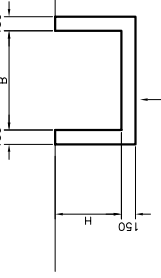


NOTE : BOULDERS SHALL BE CRUSHED ROCKS.

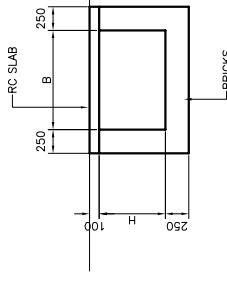
MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA	BASIC DESIGN FOR THE PROJECT FOR IMPROVEMENT AND MAINTENANCE OF NDOLA AND KITWE CITY ROADS IN THE REPUBLIC OF ZAMBIA	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	MISCELLANEOUS STRUCTURE DETAILS BOX CULVERT AT DRAGGREY AVE.(1/2)	SCALE S=1:100	APPROVED	KATAHIRA & ENGINEERS INTERNATIONAL JAPAN ENGINEERING CONSULTANTS	PREPARED CHECKED	DATE	SHEET NO
					DATE		SUBMITTED	MC-4	



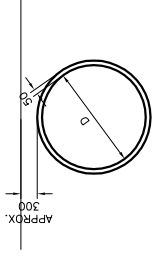
MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA	BASIC DESIGN FOR THE PROJECT FOR IMPROVEMENT AND MAINTENANCE OF NDOLA AND KITWE CITY ROADS IN THE REPUBLIC OF ZAMBIA	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	MISCELLANEOUS STRUCTURE DETAILS		SCALE S=1:50 S=1:40	APPROVED DATE	KATAHIRA & ENGINEERS INTERNATIONAL JAPAN ENGINEERING CONSULTANTS	PREPARED CHECKED SUBMITTED	DATE	SHEET NO MC-5
			BOX CULVERT AT DR.AGGREY AVE.(2/2)							



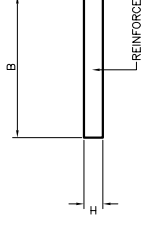
U-DITCH



BOX CULVERT

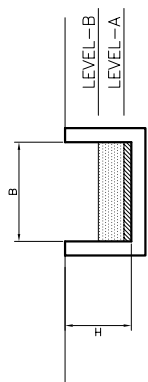


PIPE CULVERT

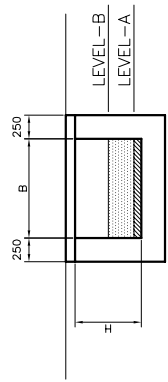


RC SLAB

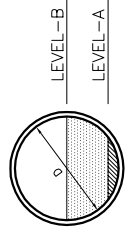
Road No.	Location	Side	Type	B(D)	H	L	Road No.	Location	Side	CROSS	Type	B(D)	H	L	Road No.	Location	Side	Type	B(D)	H	L	Road No.	Location	Side	Type	B(D)	H	L			
N2	OK142	~	OK151	L	PIPE	0.45	9.0	K2	OK187	~	OK197	L	PIPE	0.6	10.0	K3	OK585	~	OK583	L	PIPE	0.5	18.0	K10	OK608	~	OK625	R	PIPE	0.4	17.0
	OK163	~	OK172	L	PIPE	0.75	9.0		OK015	~	OK083	R	PIPE	0.5	18.0		OK642	~	OK647	R	PIPE	0.4	5.0								
	OK172	~	OK252	L	PIPE	0.4	8.00		OK075	~	OK083	L	PIPE	0.5	49.0		OK781	~	OK796	R	PIPE	0.3	15.0								
	OK252	~	OK262	L	PIPE	0.6	8.0		OK185	~	OK185	CROSS	PIPE	0.6	12.0		OK012	~	OK055	L	U DITCH	0.4	43.0								
	OK262	~	OK290	L	PIPE	0.4	28.0		OK180	~	OK185	L	PIPE	0.7	11.0		OK055	~	OK072	L	PIPE	0.6	17.0								
	OK084	~	OK092	R	PIPE	0.35	24.0		OK185	~	OK232	L	PIPE	0.6	47.0		OK118	~	OK123	L	PIPE	0.4	5.0								
	OK092	~	OK135	R	U DITCH	0.7	43.0		OK232	~	OK244	L	PIPE	0.4	12.0		OK294	~	OK304	L	U DITCH	0.5	10.0								
	OK135	~	OK154	R	PIPE	0.5	24.0		OK050	~	OK275	L	BOX	0.6	22.5		OK304	~	OK315	L	PIPE	0.3	11.0								
	OK170	~	OK176	R	PIPE	0.55	6.0		OK000	~	OK065	R	BOX	0.5	1.0		OK505	~	OK610	L	U DITCH	0.4	105.0								
	OK205	~	OK211	R	PIPE	0.55	6.0		OK060	~	OK068	L	PIPE	0.45	8.0		OK025	~	OK036	R	PIPE	0.4	11.0								
N3	OK245	~	OK251	R	PIPE	0.4	6.0	OK115	~	OK120	R	PIPE	0.3	5.0	OK114	~	OK125	R	PIPE	0.4	11.0										
	OK048	~	OK056	L	PIPE	0.45	8.0	OK115	~	OK120	R	PIPE	0.3	5.0	OK148	~	OK158	R	PIPE	0.4	10.0										
	OK068	~	OK100	L	PIPE	0.6	32.0	OK012	~	OK065	R	PIPE	0.6	75.0	OK208	~	OK219	R	BOX	0.5	11.0										
	OK182	~	OK187	L	PIPE	0.6	5.0	OK065	~	OK071	R	PIPE	0.3	6.0	OK219	~	OK230	R	BOX	0.5	8.0										
	OK240	~	OK248	L	PIPE	0.4	8.0	OK071	~	OK130	R	PIPE	0.4	20.0	OK402	~	OK412	R	U DITCH	0.5	10.0										
	OK560	~	OK567	L	PIPE	0.45	7.0	OK207	~	OK227	R	PIPE	0.6	20.0	OK412	~	OK422	R	U DITCH	0.5	10.0										
	OK562	~	OK639	L	BOX	0.4	0.4	OK033	~	OK037	L	PIPE	0.6	4.0	OK422	~	OK478	R	U DITCH	0.4	56.0										
	OK005	~	OK007	R	PIPE	0.45	2.0	OK097	~	OK101	R	PIPE	0.6	4.0	OK478	~	OK497	R	PIPE	0.4	19.0										
	OK010	~	OK018	R	PIPE	0.45	2.0	OK138	~	OK140	R	PIPE	0.6	2.0	OK523	~	OK568	R	U DITCH	0.4	45.0										
	OK048	~	OK056	R	BOX	0.3	0.4	OK198	~	OK203	R	PIPE	0.6	5.0	OK576	~	OK592	R	U DITCH	0.5	16.0										
N4	OK056	~	OK070	R	PIPE	0.45	14.0	OK220	~	OK225	R	PIPE	0.6	5.0	OK609	~	OK614	R	PIPE	0.3	5.0										
	OK070	~	OK075	R	PIPE	0.6	5.0	OK232	~	OK237	R	PIPE	0.6	5.0	OK614	~	OK698	R	U DITCH	0.4	84.0										
	OK408	~	OK414	R	PIPE	0.6	6.0	OK258	~	OK263	R	PIPE	0.6	5.0	OK042	~	OK074	R	U DITCH	0.4	32.0										
	OK030	~	OK036	R	PIPE	0.4	21.0	OK336	~	OK341	R	PIPE	0.6	73.0	OK074	~	OK084	R	PIPE	0.5	10.0										
	OK287	~	OK290	R	PIPE	0.6	13.0	OK336	~	OK341	R	PIPE	0.6	73.0	OK287	~	OK296	R	PIPE	0.5	9.0										
	OK360	~	OK366	R	PIPE	0.6	13.0	OK627	~	OK627	CROSS	PIPE	0.6	5.0	OK350	~	OK355	R	PIPE	0.3	5.0										
	OK390	~	OK390	R	PIPE	0.45	8.0	OK850	~	OK850	CROSS	PIPE	0.3	10.0	OK468	~	OK481	R	PIPE	0.5	13.0										
	OK390	~	OK390	R	PIPE	0.45	8.0	OK950	~	OK950	CROSS	PIPE	0.4	11.0	OK605	~	OK616	R	PIPE	0.5	11.0										
	OK390	~	OK390	R	PIPE	0.45	8.0	OK950	~	OK950	CROSS	PIPE	0.4	11.0	OK090	~	OK117	L	PIPE	0.3	27.0										
	OK411	~	OK415	R	PIPE	0.6	4.0	OK375	~	OK423	R	PIPE	0.5	11.0	OK140	~	OK157	L	PIPE	0.5	14.0										
N5	OK411	~	OK415	R	PIPE	0.6	4.0	OK375	~	OK423	R	PIPE	0.5	11.0	OK250	~	OK262	L	PIPE	0.45	12.0										
	OK488	~	OK498	R	PIPE	0.6	10.0	OK727	~	OK734	R	BOX	0.7	7.0	OK297	~	OK313	L	PIPE	0.4	16.0										
	OK560	~	OK612	R	PIPE	0.85	0.5	OK785	~	OK792	R	BOX	0.7	7.0	OK343	~	OK351	L	PIPE	0.3	8.0										
	OK612	~	OK622	R	PIPE	0.45	10.0	OK812	~	OK818	R	BOX	0.9	0.5	7.0	OK390	~	OK401	L	PIPE	0.4	11.0									
	OK760	~	OK772	R	PIPE	0.5	12.0	OK928	~	OK935	R	PIPE	0.4	7.0	OK472	~	OK482	L	PIPE	0.45	10.0										
	OK008	~	OK013	R	PIPE	0.6	5.0	OK000	~	OK038	L	BOX	0.9	0.5	8.0	OK248	~	OK256	R	PIPE	0.4	8.0									
	OK050	~	OK055	R	PIPE	0.6	5.0	OK078	~	OK078	R	BOX	0.6	0.4	8.0	OK262	~	OK272	R	PIPE	0.6	10.0									
	OK062	~	OK067	R	PIPE	0.6	5.0	OK152	~	OK159	R	BOX	0.6	0.4	7.0	OK290	~	OK295	R	PIPE	0.35	5.0									
	OK278	~	OK283	R	PIPE	0.4	5.0	OK212	~	OK218	R	BOX	0.6	0.4	6.0	OK312	~	OK352	R	PIPE	0.4	40.0									
	OK339	~	OK344	R	PIPE	0.4	5.0	OK300	~	OK308	L	BOX	0.5	8.0	OK355	~	OK360	R	PIPE	0.4	5.0										
N7	OK350	~	OK355	R	PIPE	0.4	5.0	OK950	~	OK950	R	BOX	0.5	7.0	OK002	~	OK045	R	U DITCH	0.6	43.0										
	OK350	~	OK355	R	PIPE	0.4	5.0	OK950	~	OK950	R	BOX	0.5	7.0	OK045	~	OK056	R	PIPE	0.5	11.0										
	OK379	~	OK383	R	PIPE	0.2	4.0	OK760	~	OK767	R	BOX	0.8	0.5	7.0	OK056	~	OK078	R	U DITCH	0.5	22.0									
	OK460	~	OK465	R	U DITCH	0.4	0.7	OK855	~	OK862	R	PIPE	0.5	8.0	OK078	~	OK095	R	PIPE	0.5	17.0										
	OK462	~	OK468	R	PIPE	0.45	6.0	OK915	~	OK922	R	PIPE	0.3	8.0	OK095	~	OK183	R	PIPE	0.3	11.0										
	OK507	~	OK511	R	PIPE	0.3	14.0	OK915	~	OK922	R	PIPE	0.3	8.0	OK183	~	OK194	R	PIPE	0.3	11.0										
	OK557	~	OK571	R	PIPE	0.3	14.0	OK915	~	OK922	R	PIPE	0.3	8.0	OK194	~	OK220	R	U DITCH	0.4	26.0										
	OK605	~	OK609	R	PIPE	0.5	4.0	OK915	~	OK922	R	PIPE	0.3	8.0	OK220	~	OK220	R	U DITCH	0.4	26.0										
	OK618	~	OK622	R	PIPE	0.4	4.0	OK915	~	OK922	R	PIPE	0.3	8.0	OK220	~	OK220	R	U DITCH	0.4	26.0										
	OK618	~	OK622	R	PIPE	0.4	4.0	OK915	~	OK922	R	PIPE	0.3	8.0	OK220	~	OK220	R	U DITCH	0.4	26.0										
N9	OK618	~	OK622	R	PIPE	0.4	4.0	OK915	~	OK922	R	PIPE	0.3	8.0	OK220	~	OK220	R	U DITCH	0.4	26.0										
	OK618	~	OK622	R	PIPE	0.4	4.0	OK915	~	OK922	R	PIPE	0.3	8.0	OK220	~	OK220	R	U DITCH	0.4	26.0										
	OK618	~	OK622	R	PIPE	0.4	4.0	OK915	~	OK922	R	PIPE	0.3	8.0	OK220	~	OK220	R	U DITCH	0.4	26.0										
	OK618	~	OK622	R	PIPE	0.4	4.0	OK915	~	OK922	R	PIPE	0.3	8.0	OK220	~	OK220	R	U DITCH	0.4	26.0										
	OK618	~	OK622	R	PIPE	0.4	4.0	OK915	~	OK922	R	PIPE	0.3	8.0	OK220	~	OK220	R	U DITCH	0.4	26.0										
	OK618	~	OK622	R	PIPE	0.4	4.0	OK915	~	OK922	R	PIPE	0.3	8.0	OK220	~	OK220	R	U DITCH	0.4	26.0										
	OK618	~	OK622	R	PIPE	0.4	4.0	OK915	~	OK922	R	PIPE	0.3	8.0	OK220	~	OK220	R	U DITCH	0.4	26.0										
	OK618	~	OK622	R	PIPE	0.4	4.0	OK915	~	OK922	R	PIPE	0.3	8.0	OK220	~	OK220	R	U DITCH	0.4	26.0										
	OK618	~	OK622	R	PIPE	0.4	4.0	OK915	~	OK922	R	PIPE	0.3	8.0	OK220	~	OK220	R	U DITCH	0.4	26.0										
	OK618	~	OK622	R	PIPE	0.4	4.0	OK915	~	OK922	R	PIPE	0.3	8.0	OK220	~	OK220	R	U DITCH	0.4	26.0										
K8	OK323	~	OK329	R	BOX	0.6	6.0	OK142	~	OK152	L	PIPE	0.5	10.0	OK485	~	OK485	R	PIPE	0.5	12.0										
	OK142	~	OK152	L	PIPE	0.5	10.0	OK171	~	OK180	L	PIPE	0.5	9.0	OK489	~	OK489	R	PIPE	0.5	24.0										
K1																															



U-DITCH



BOX CULVERT



PIPE CULVERT

LEVEL-A: DEPOSITE VOLUME IS APPROXIMATELY 10% OF SECTIONAL AREA.
LEVEL-B: DEPOSITE VOLUME IS APPROXIMATELY 50% OF SECTIONAL AREA.

Road No.	Location	Side	Type	B(D)	H	L	LEVEL	Road No.	Location	Side	Type	B(D)	H	L	LEVEL
N1	0K832 ~ 0K857	L	U DITCH	0.6	0.6	30.0	A	K2	0K315 ~ 0K385	R	U DITCH	0.4	0.5	70.0	A
	0K674 ~ 0K680	R	PIPE	0.4	-	6.0	A		0K472 ~ 0K483	R	PIPE	0.9	-	11.0	A
	0K711 ~ 0K721	R	PIPE	0.45	-	10.0	A		0K483 ~ 0K492	R	U DITCH	0.6	0.7	9.0	A
	0K741 ~ 0K756	R	PIPE	0.4	-	15.0	A		0K483 ~ 0K516	R	PIPE	0.4	-	33.0	A
N2	0K756 ~ 0K816	R	U DITCH	0.4	0.4	60.0	A	0K518 ~ 0K575	R	U DITCH	0.5	0.7	57.0	A	
	0K830 ~ 0K860	R	U DITCH	0.4	0.4	30.0	A	0K244 ~ 0K271	L	U DITCH	0.5	0.5	27.0	A	
N3	0K000 ~ 0K026	L	PIPE	0.7	-	30.0	B	0K271 ~ 0K304	L	PIPE	0.4	-	33.0	A	
	0K026 ~ 0K142	L	U DITCH	0.5	0.9	116.0	A	0K304 ~ 0K316	L	PIPE	0.3	-	26.0	A	
	0K000 ~ 0K084	R	U DITCH	0.7	1.0	84.0	A	0K316 ~ 0K342	L	BOX	0.5	0.5	12.0	A	
	0K153 ~ 0K161	L	PIPE	0.6	-	8.0	B	0K342 ~ 0K359	L	U DITCH	0.4	0.5	16.0	A	
	0K508 ~ 0K551	R	U DITCH	1.0	1.2	43.0	A	0K120 ~ 0K125	R	PIPE	0.6	-	5.0	A	
	0K551 ~ 0K558	R	PIPE	0.9	-	7.0	A	0K125 ~ 0K135	R	U DITCH	0.5	0.7	10.0	A	
	0K558 ~ 0K585	R	U DITCH	1.0	1.2	27.0	A	0K135 ~ 0K180	R	U DITCH	0.5	0.5	25.0	A	
	0K588 ~ 0K600	R	U DITCH	1.0	1.2	12.0	A	0K195 ~ 0K225	R	U DITCH	0.5	0.7	30.0	A	
	0K683 ~ 0K693	R	BOX	0.45	0.5	10.0	B	0K242 ~ 0K280	R	BOX	0.6	0.7	38.0	A	
	0K799 ~ 0K815	R	PIPE	0.9	-	16.0	A	0K280 ~ 0K292	R	PIPE	0.4	-	12.0	A	
N4	1K457	L	PIPE	0.6	-	15.0	A	0K292 ~ 0K325	R	U DITCH	0.4	0.5	33.0	A	
	1K726 ~ 1K756	L	U DITCH	0.8	0.8	30.0	A	0K325 ~ 0K332	R	PIPE	0.4	-	7.0	A	
N8	0K900 ~ 1K075	L	U DITCH	1.8	1.2	175.0	A	0K332 ~ 0K342	R	U DITCH	0.5	0.5	10.0	A	
	1K100 ~ 1K325	L	U DITCH	1.8	1.2	225.0	B	0K342 ~ 0K354	R	PIPE	0.5	-	12.0	A	
	1K325 ~ 1K336	L	BOX	2.0	1.3	11.0	B	0K930 ~ 0K938	L	PIPE	0.8	-	8.0	A	
	1K336 ~ 1K425	L	U DITCH	1.8	1.2	89.0	B	0K990 ~ 0K100	R	BOX	0.6	0.7	10.0	A	
	1K555 ~ 2K460	L	U DITCH	1.8	1.2	905.0	B	0K545 ~ 0K552	R	PIPE	0.4	-	7.0	B	
	0K000 ~ 0K045	R	U DITCH	1.8	1.0	50.0	B	0K636 ~ 0K647	R	PIPE	0.9	-	11.0	B	
K1	0K050 ~ 0K065	R	U DITCH	1.8	1.0	15.0	B	0K685 ~ 0K696	R	PIPE	0.9	-	14.0	B	
	0K075 ~ 0K095	R	U DITCH	1.8	1.0	25.0	B	0K442 ~ 0K451	L	PIPE	0.5	-	9.0	A	
	0K095 ~ 0K100	R	PIPE	0.9	-	9.0	B	0K560 ~ 0K566	L	PIPE	0.5	-	6.0	A	
	0K300 ~ 0K600	L	U DITCH	0.5	0.6	300.0	A	0K566 ~ 0K576	L	PIPE	0.45	-	10.0	A	
	0K300 ~ 0K600	R	U DITCH	0.5	0.6	300.0	A	0K755 ~ 0K790	L	U DITCH	0.6	0.9	35.0	A	
	0K083 ~ 0K092	R	PIPE	0.6	-	9.0	A	0K790 ~ 0K797	L	PIPE	0.6	-	7.0	A	
K2	0K092 ~ 0K130	R	U DITCH	0.5	0.7	38.0	A	0K812 ~ 0K822	L	PIPE	0.45	-	10.0	A	
	0K130 ~ 0K149	R	PIPE	0.9	-	19.0	A	0K697 ~ 0K741	R	U DITCH	0.6	0.7	44.0	A	
	0K149 ~ 0K240	R	U DITCH	0.4	0.5	91.0	A	0K754 ~ 0K783	R	U DITCH	1.0	1.0	29.0	A	
	0K240 ~ 0K247	R	PIPE	0.6	-	7.0	A	0K175 ~ 0K184	R	BOX	0.65	0.4	9.0	A	
K14	0K247 ~ 0K305	R	U DITCH	0.4	0.5	58.0	A	0K730 ~ 0K805	R	U DITCH	0.5	0.5	75.0	A	
								0K860 ~ 1K060	R	U DITCH	0.7	0.7	200.0	A	
								1K060 ~ 1K080	R	PIPE	0.7	-	36.0	A	

Note : L=Length(m)
Unit of size is meter.

MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA	BASIC DESIGN FOR THE PROJECT FOR IMPROVEMENT AND MAINTENANCE OF NDOLA AND KITWE CITY ROADS IN THE REPUBLIC OF ZAMBIA	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	MISC	SCALE	APPROVED	KATAHIRA & ENGINEERS INTERNATIONAL JAPAN ENGINEERING CONSULTANTS	PREPARED CHECKED	DATE	SHEET NO
					DATE		SUBMITTED		

2.2.4 IMPLEMENTATION PLAN

2.2.4.1 Implementation Policy

The basic concepts for implementation of the Project are as follows:

- On reaching an agreement and signing the exchange of note by both Governments of Japan and Zambia, the Project will be implemented in accordance with the guideline of Japan's Grant Aid.
- The Ministry of Local Government and Housing of Government of Zambia and Ndola and Kitwe City Councils are responsible for the Project implementation.
- Assistance in tendering and construction supervision will be undertaken by a Japanese consulting firm in accordance with a contract between the Ministry and the consultant.
- A Japanese pre-qualified tenderer who has been awarded the contract by the Ministry will undertake the implementation of the Project.

The basic concepts for the construction are as follows:

- Materials and laborers for the project are procured in Zambia as much as possible. If required qualities and capacities are not enough, materials and laborers may be procured from third countries and/or Japan.
- Construction method and schedule for the Project shall be planned on the basis of meteorological, topographic and geological conditions.
- Special construction method which requires special material, equipment or technology shall not be planned.
- Proper construction specifications shall be prepared and the construction shall be supervised in accordance with the specification.
- Safety of the construction staff and public in the construction area shall be secured during the construction. Educative training on environmental and anti-AID/HIV shall be provided.
- Countermeasures to control pollution caused by the construction shall be taken. Polluted water shall not be discharged. Noise and dust from crushing and asphalt plants shall be limited. Construction waste shall be treated or dump in a proper site approved by the ECZ.

2.2.4.2 Implementation Conditions

Construction plan and method shall be prepared in order to secure the safety of the construction staff and the third parties including road users and road side residents.

Safety management for the present road conditions

Approximately half of the roads are paved with DBST that have been deteriorated due to the recent increase of traffic volume. During rainy season, potholes and stagnant water badly disrupt activities of mineral industry and commerce, commuting to office, school and hospital which are absolutely important for proper living standards of the people. Thus safety and traffic management for road users and mitigation measures of environment for road side residents shall be considered in preparation of the construction plan.

Climate and Natural Conditions

Ndola and Kitwe cities are both neighboring, located at approximately 300km north far from Lusaka and on the border of the Democratic Republic of Congo. There are three seasons; dry season (September to November), rainy season (December to March) and cool season (April to August). Altitude is approximately 1,200m on the plateau and no soft foundation is found. Pavement work will be implemented in dry season, because the work will be troubled by rain.

Safety management for road side residents and construction personnel

The construction will occupy one lane. To secure traffic on the roads under construction, one lane space will be secured to deal alternating traffic.

Safety for Road Side Residents: Construction yards will be definitely separated by using security facilities such as construction signs, traffic control signs, detour signs allows, barricades, safety cones, lighting signs and so on as well as traffic controllers.

Safety Management for Construction Personnel: Guard persons will be provided to avoid collision with heavy machines.

Consideration for Environment

- Debris and waste from removal of the present pavement and bridges shall be done in proper manner to mitigate the environment.
- Selection of borrow pits will be made with consultation of the relevant authorities, and at the location with the least negative impacts to the environment.
- A construction method causing vibration and noise shall be avoided during early morning and night time.
- Dust control will be done by spraying water promptly.
- Provision of information and educative training on work safety and public health measures

(Malaria, Sex related disease, AIDS/HIV) will be conducted for the construction staff.

2.2.4.3 Scope of Works

Undertakings of both Governments of Japan and Zambia, are listed in Table 2.2.4-1.

Table 2.2.4-1 Undertakings of Both Governments

Items	Contents	Undertaken by		Remarks
		Japan	Zambia	
Procurement of materials and equipment	Procurement	○		
	In-land transportation clearance		○	
Temporary work	Right of way acquisition		○	Site office, stock yard, work shop, etc.
	Relocation of encroachment of kiosk		○	
	Provision of Borrow pit and quarry site		○	
	Provision of Wasted area		○	
	Other work	○		
Relocation of obstacles, etc.	Construction obstacles		○	Electric poles & wires, telephone cables, etc.
	Removal of present temporary bridge	○		K1: Present bridge
Main work	Improvement of the road	○		

2.2.4.4 Construction Supervision Plan

A Japanese consultant will carry out detailed design, assistance in tendering and construction supervision in accordance with the consultant contract agreed by both Government of Zambia and the consultant.

(1) Detailed design

- To confirm the contents of the Project with the Implementing Agencies in Zambia
- To conduct detailed survey and design and preparation of detailed drawings
- To conduct detailed construction planning and cost estimate

(2) Tender services

The following services in the period from tender notice to construction contract are as follows:

- Preparation of tender documents
- Tender notice
- Prequalification
- Tendering
- Tender evaluation
- Contract facilitation

The duration of assistance in tendering will require three months after signing of EN for each phase.

(3) Construction supervision

The consultant will carry out supervision of the construction to be executed by a contractor according to the contract and implementation plan. Major work items are as follows:

- Inspections and approvals of site surveys
- Inspections and approvals of construction plans
- Quality control
- Progress control
- Measurement of the work
- Inspection of safety aspects
- Final inspection and turn-over

The Consultant will assign a stationed supervising engineer to the site. The Construction will be carried out simultaneously in Ndola and Kitwe cities. During construction, the Consultant will collaborate with work safety management staff of the Contractor to prevent accidents at the site.

2.2.4.5 Quality Control Plan

The major items of the quality control plan for concrete work and for earthwork and pavement work are shown in Table 2.2.4-2 and 2.2.4-3 respectively.

Table 2.2.4-2 Quality Control Plan for Concrete Work

Item	Test item	Test method (Specification)	Frequently of tests
Cement	Physical property test	AASHTO M85	Once before trail mix; thence once in 500m ³ of concrete. Once if material source is changed
Fine Aggregate	Physical property test	AASHTO M6	Once before trail mix; thence once in 500m ³ . Once if material source is changed.
	Sieve analysis	AASHTO T27	Once a month
Course Aggregate	Physical property test	AASHTO M80	Once before trail mix; thence once in 500m ³ . Once if material source is changed (Data of procurement is confirmed).
	Sieve analysis	AASHTO T27	Once a month
Water	Quality test	AASHTO T26	Once before trail mix
Concrete	Slump test	AASHTO T119	Twice a day
	Air content test	AASHTO T121	Twice a day
	Compressive strength test	AASHTO T22	6 specimens in each concreting. Incase of large amount in each concreting, 6 specimens every 75 m ³ (3 for 7 day strength and 3 for 28 day strength)
	Temperature test	—	Twice a day
	Salinity test	—	Twice a day

Table 2.2.4-3 Quality Control Plan for Earthwork and Pavement Work

Items	Test items	Test method (Specification)	Frequently of tests
Embankment	Compaction	AASHTO T180	Once before trial embankment
	Soak CBR	AASHTO T193	Once before trial embankment
	Field Density	AASHTO T191	Once in 500 m ²
Base course/ Sub-base	Sieve Analysis	AASHTO T27	Once before trial work
	Compaction	AASHTO T180	Once before trial work
	Soak CBR	AASHTO T193	Once before trial work
	Consistency	AASHTO T89, 90	Once before trial work
	Abrasion	AASHTO T96	Once before trial work
	Field Density	AASHTO T191	Twice in 1000 m ²
Asphalt Concrete	Sieve Analysis	AASHTO T27	Once before trial mix
	Abrasion test of aggregate	AASHTO T96	Once before trial mix
	Density of mix	AASHTO T166	Once in 1000 m ²
	Asphalt content and Aggregate grading of mix	AASHTO T164	Once a day
	Temperature of mix		Every truck

2.2.4.6 Procurement Plan

(1) Construction Material

All construction materials necessary for the Project such as asphalt, sand, aggregates and crushed stones, ready-mixed concrete (site production) are usually available in Zambian markets either locally or through imports. The procurement plan for major materials is as follows and as shown in Table 2.2.4-4.

- Procurement in Zambia when materials are available in domestic markets,
- Procurement by import from Japan and/or third countries when materials are not available in Zambia. The exporting countries will be decided by taking quality, price, availability and supply period into consideration.

Table 2.2.4-4 Procurement Plan of Major Material

Item	Procurement from			Remarks
	Zambia	Japan	3 rd country	
<u>Materials for Structure</u>				
Crushed stone	○			
Cement	○			
Sand	○			
Sub-base material	○			
Ready mixed concrete	○			(site production)
Crushed stone for asphalt concrete	○			
Asphalt concrete				
Re-bar : D9~ D 32	○			
Admixture for concrete	○			
Shape steel	○			
Rubble for wet masonry	○			
PVC pipe : D = 50~200	○			
R C pipe ° : D = 600~1200	○			
Traffic signboard	○			
Plywood for form (waterproof)	○			
Plywood for form (w/out waterproof)	○			
Support timber and log for scaffold	○			
Electric welding rod	○			
Fuel and lubrication	○			
Oxygen and acetylene	○			
Gas cutter	○			

(2) Equipment

Policy to procure equipment is as follows:

- Equipment owned by Local contractors will be hired or leased.
- The equipment required for the Project will be available in Zambia.

Major equipment procurement plan is shown in Table 2.2.4-5.

Table 2.2.4-5 Major Equipment Procurement Plan

Equipment	Size	Lease/ Procurement	Procured from			Reason of procurement	Carriage
			Zambia	Third country	Japan		
Backhoe	0.28m ³	Lease	○				
Backhoe	0.35m ³	Lease	○				
Backhoe	0.6m ³	Lease	○				
Bulldozer	15t	Lease	○				
Bulldozer	21t	Lease	○				
Motor grader	3.1m	Lease	○				
Road roller	10-12t	Lease	○				
Tire roller	8-20t	Lease	○				
Vibration roller	3-5t	Lease	○				
Vibration roller	7t	Lease	○				
Wheel loader	1.0m ³	Lease	○				
Wheel loader	2.0m ³	Lease	○				
Asphalt finisher	2.4-2.5m	Lease	○				
Sprinkler truck	6.0kl	Lease	○				
Dump truck	10 t	Lease	○				
Truck crane	4.8-4.9t	Lease	○				
Truck crane	20 t	Lease	○				
Trailer truck	20t	Lease	○				
Trailer truck	30t	Lease	○				
Cement mixing plant	100t/h	Lease	○				
Generator	35KVA	Lease	○				
Generator	60KVA	Lease	○				
Generator	100KVA	Lease	○				
Generator	250KVA	Lease	○				
Submersible pump	150mm	Lease	○				
Submersible pump	100mm	Lease	○				
Compressor	5m ³	Lease	○				
Compressor	10m ³	Lease	○				
Concrete Mixer	0.4-0.6m ³	Lease	○				

2.2.4.7 Implementation Schedule

Implementation schedule is shown in Table 2.2.4-6.

Table 2.2.4-6 Implementation Schedule

Stage	Work Item	Month																		
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
Phase I	Execution Design	Detail Design	Site Investigation	■																
		Detail Design	Design in Japan	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
			Finalization				■	■	■	■	■	■	■	■	■	■	■	■	■	■
	Site Execution	Preparatory Work	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
		Earthwork		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
		Main Line Work			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
		Road Facility Work				■	■	■	■	■	■	■	■	■	■	■	■	■	■	
		Drainage			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
		Footpath Work				■	■	■	■	■	■	■	■	■	■	■	■	■	■	
		Structure Work			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
		Cleaning																		■
Phase II	Execution Design	Detail Design	Site Investigation	■																
		Detail Design	Design in Japan	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
			Finalization				■	■	■	■	■	■	■	■	■	■	■	■	■	■
	Site Execution	Preparatory Work	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
		Earthwork		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
		Main Line Work			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
		Road Facility Work				■	■	■	■	■	■	■	■	■	■	■	■	■	■	
		Drainage			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
		Footpath Work				■	■	■	■	■	■	■	■	■	■	■	■	■	■	
		Structure Work																		
		Cleaning																		■

2.3 OBLIGATIONS OF THE GOVERNMENT OF ZAMBIA

The Government of Zambia will undertake the following measures on condition that the Grant Aid by the Government of Japan is extended to the Project.

- To provide data and information necessary for the Project.
- To secure the land necessary for the execution of the Project, such as the land for temporary offices, construction works, storage yards and others.
- To provide borrow pits, quarry sites and waste area
- To bear commissions to the bank in Japan for its banking service in connection with the Project.
- To ensure prompt tax exemption, customs clearance and effective inland transportation of material and equipment.
- To exempt Japanese nationals engaged in the Project from any customs duties for the supply of products and services necessary for the project.
- To accord Japanese nationals necessary legal rights for their entry and stay in Zambia.
- To provide all necessary permission, licenses and certificates in connection with environmental issues and earthwork for the Project (EIA approval, construction permission, traffic control permission, detour permission, construction permission in river, earthwork permission etc.)
- To relocate all obstruction structures like electric poles and cables, telephone cables, water pipe etc. in the project road
- To arrange proper use and effective maintenance of the road after the completion of the project.
- To coordinate and solve any issues related to the Project that may be raised from inhabitants or third parties.
- To bear all the expenses, other than covered by the Japanese Grant Aid, agreed and necessary for the Project.
- To secure safety of the construction site

2.4 PROJECT OPERATION AND MAINTENANCE PLAN

(1) Organization for operation and maintenance

Road maintenance after the Project is under the responsibility of Engineering Service Department of Ndola and Kitwe City Councils. The ESD of Ndola has 30 persons in the Roads Section and 10 persons in Mechanical Section; the ESD of Kitwe has 35 persons in the Road Section and 8 persons in Mechanical Section. As the road maintenance of the Project is standard work, and there is no technical problem, they will have reasonable capability for the road maintenance requirements.

(2) Maintenance plan

Necessary maintenance is as follows:

Daily maintenance: Routine inspection and cleaning side ditches and culverts

Repair for damaged part: Patching pavement, repainting road marking and other damaged parts

(3) Present operation of maintenance and recommendations

Present operation of maintenance is as follows:

Routine maintenance: Road surface are well cleaned.

Daily Repair: Road damages are not adequately repaired.

It is important to achieve effective results from maintaining facilities sufficiently to keep in good condition the carriageway, including the sustainability of road facilities in good condition, so the following recommendations are made:

- To check facilities regularly for controlling their conditions.
- To clean facilities up, especially drainage.
- To secure necessary budget for maintenance.

2.5 PROJECT COST ESTIMATION

2.5.1 Initial Project Cost

(1) Cost borne by the Government of Japan

The project will be implemented in accordance with the Japan's Grant Aid scheme and the cost will be determined before concluding the Exchange of Note for the Project.

(2) Cost borne by the Government of the Republic of Zambia

Total Cost: Approximately 1,186 Million Kwacha (34.6 Million Yen)

①	Advising Commission	76 Million Kwacha	(2.2 Million Yen)
②	Payment Commission	90 Million Kwacha	(2.6 Million Yen)
③	Relocation Cost	1,020 Million Kwacha	(29.8 Million Yen)

(3) Conditions in Cost Estimate

- ① Time of Cost Estimate: March 2007
- ② Exchange Rate : 1US Dollar=119.59Yen, 1 US\$ = 4,110 Kwacha
- ③ Construction Period: As shown in Section 2.2.4.7 Implementation Schedule
- ④ Cost estimate is implemented in accordance with the guideline of Japan's Grant Aid.

2.5.2 Maintenance Cost

The following organization is in charge of maintenance for the road to be rehabilitated by the Project:

- Ndola City: 9 road sections (12.73km): Ndola Engineering Service Department
- Kiwte City: 14 road sections (11.63km): Kitwe Engineering Service Department

Annual maintenance cost necessary for the road is estimated at 29,193 thousand Kwacha (US\$7,100) in Ndoala City and 27,314 thousand Kwacha (US\$ 6,650) in Kitwe City. Details are shown in Table 2.5-1 and 2.5-2.

Table 2.5-1 Maintenance Work and Annual Cost in Ndola City

1. Routine Inspection (Undertaken by Engineering Service Department) (Unit: Kwacha)

Facility	Inspection Item	Frequency	No. of staff	Equipment	Quantity	Unit Price	Cost
Pavement	Crack, deformation, pothole, etc.	12 times a year	2 persons	Scoop, hammer, sickle, barricade,	24 man-day / year	35,000 /day	840,000
Shoulder/slope	Rainwater erosion & collapse, etc.	1 day each time					
Road marking	Injury, deformation, staining, splitting			pick-up truck	12 veh-day / year=96 hours/year (8 hours/day)	29,400/h	2,822,400
Drainage	Damage and obstruction						
Total							3,662,400

2. Daily maintenance work (Undertaken by Engineering Service Department) (Unit: Kwacha)

Facility	Inspection Item	Frequency	No. of staff	Equipment	Quantity	Unit Price	Cost
Cleaning		4 times a year	5 persons	Scoop, hammer, sickle, barricade,	80 man-day / year	22,800 /man-day	1,904,000
Drainage	Cleaning soil, obstacles						
Pavement	Cleaning	4 days each time					
Shoulder	Cutting grass, cleaning						
Road marking	Cleaning			Pick-up truck (2 units)	12 veh-day/ year (8 hours/day)	29,400 /v-h	1,881,600
Total							3,785,000

Total: Inspection and Routine Maintenance 7,448,000

3. Repair (Undertaken by Contractor) (Unit: Kwacha)

Facility	Repair Item	Quantity	Unit Price	Cost per km	Road length
Pavement	Sealing crack,	1 m ² per km (0.01mx100m)	10,300/m ²	10,300	12.73km (9sect.)
	Patching pothole	5 m ² per km	51,400/m ²	257,000	
Shoulder/slope	Repairing damaged part	Sealing 3.3 m ² +patching 1.7 m ²	-	470,900	
Road marking	Repainting	100m per km	1,700/m	970,000	
Total				1,708,200	21,745,000

Grand Total 29,193,000

Table 2.5-2 Maintenance Work and Annual Cost in Kitwe City

1. Routine Inspection (Undertaken by Engineering Service Department) (Unit: Kwacha)

Facility	Inspection Item	Frequency	No. of staff	Equipment	Quantity	Unit Price	Cost
Pavement	Crack, deformation, pothole, etc. Rainwater erosion & collapse, etc.	12 times a year	2 persons	Scoop, hammer, sickle, barricade,	24 man-day / year	35,000 /day	840,000
Shoulder/slope							
Road marking	Injury, deformation, stain, splitting Damage and obstruction	1 day each time		pick-up truck	12 veh-day / year=96 hours/year (8 hours/day)	29,400 /hour	2,822,400
Drainage							
Total							3,662,400

2. Daily maintenance work (Undertaken by Engineering Service Department) (Unit: Kwacha)

Facility	Inspection Item	Frequency	No. of staff	Equipment	Quantity	Unit Price	Cost
Cleaning	Cleaning soil, obstacles	4 times a year	5 persons	Scoop, hammer, sickle, barricade,	80 man-day / year	23,800 /m-day	1,904,000
Drainage							
Pavement	Cleaning	4 days each time		Pick-up truck (2 units)	12 veh-day/ year (8 hours/day)	29,400 /v-h	1,881,600
Shoulder	Cutting grass, cleaning						
Road marking	Cleaning						
Total							3,785,600

Total: Inspection and Routine Maintenance 7,448,000

3. Repair (Undertaken by Contractor) (Unit: Kwacha)

Facility	Repair Item	Quantity	Unit Price	Cost per km	Road length
Pavement	Sealing crack,	1 m ² per km (0.01mx100m)	10,300/m ²	10,300	11.63km (14 sections)
	Patching pothole	5 m ² per km	51,400/m ²	257,000	
Shoulder/slope	Repairing damaged part	Sealing 3.3 m ² +patching 1.7 m ²	-	470,900	
Road marking	Repainting	100m per km	1,700/m	970,000	
Total				1,708,200	19,866,000

Grand Total 27,314,000

CHAPTER 3 PROJECT EVALUATION AND RECOMMENDATIONS

3.1 PROJECT EFFECTS

(1) Beneficial Population

The direct beneficiaries of the Project are the population of approximately 783,000 (394,000 in Ndola City and 389,000 in Kitwe City), whereas the indirect beneficiaries are population of approximately 1,658,000 in Copperbelt Province.

(2) Direct Effects

- (i) The travel speed will be increased from 18.7km/h to 40.0km/h.
- (ii) The traffic accidents will be reduced by repairing of potholes which cause sudden stops and turnings of vehicles, installation of traffic safety measures (sign boards, crosswalks, humps etc.) and provision of footpaths.

(3) Indirect Effects

- (i) Products of mining and manufacturing industries are expected to be more competitive by reducing transportation cost and vitalize the local economy.
- (ii) Improving convenience for the people to do their daily activities by improving mobility due to provision of fast, comfortable and reliable public transportation and improving accessibility of the low and middle income groups to hospitals and schools.

3.2 RECOMMENDATIONS

The followings recommendations are intended for the Zambian side to maximize the Project effects:

- To continue human resource development of engineers and technicians in order to enhance road maintenance and management,
- To secure the budgets for road maintenance and management in accordance with the long-term road maintenance program, and
- To regulate and reinforce the ban on overloading of heavy vehicles in order to optimize the pavement durability.